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GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

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COAL RESOURCES, NEBO COALFIELD

DIAMOND DRILLING OF THE ELPHINSTONE SEAM

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SUMMARY

★

During 1948–50, thirty boreholes were drilled to test the Elphinstone Seam for open-cut exploitation. Reserves proved were estimated at 16 million tons in the Lake Elphinstone Area and 7 million tons in the Kemmis Creek Area, with cover less than 150 feet.

In 1959, a further thirty boreholes were drilled by the Department of Mines under an agreement with New Consolidated Goldfields (A/asia) Pty. Ltd., holders of twenty-three coal mining leases covering the previously tested section of the field and presumed extensions to the north-west and south-east. The company was responsible for geological field services, including selection of sites, while the Geological Survey undertook examination and sampling of coal sections.

Drilling showed the seam to extend to the south-east in workable condition for less than half a mile, beyond which it deteriorates progressively due to shale banding and for a distance is also affected by a basaltic intrusion. South of the intruded area, however, sections of the seam would be suitable for underground mining.

Attempts to trace the seam north-westerly from the Lake Elphinstone Area were unsuccessful because of a wide zone of faulting.

Results of the programme were disappointing in that additional open-cut reserves proved in the Kemmis Creek Area amount to only 1½ million tons. However, the combined results of the two drilling programmes indicate that very large reserves are available for underground mining. Deeper drilling to determine any deteriorated or intruded areas would be prerequisite to such development.

H. G. S. CRIBB,

Assistant Chief Government Geologist.

COAL RESOURCES—NEBO COALFIELD
DIAMOND DRILLING OF THE ELPHINSTONE SEAM

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INTRODUCTION

The first record of coal in the Nebo Coalfield, located approximately 60 miles west-south-west of Mackay, was published by Jack (1887). No intensive prospecting of the area for coal was done till 1948 when a diamond drilling campaign was commenced on behalf of Power and Traction Finance Company Limited and later Electric Supply Corporation (Overseas) Limited. This drilling prospected at shallow depth a seam, which was subsequently named Elphinstone Seam.

Towards the end of 1949, these two companies withdrew in turn from the project and from then till May, 1950, drilling was financed by the Department of Mines. In addition, a shaft was sunk and sampled to test the quality of the seam, as core recoveries in the boreholes were insufficient to allow accurate appraisal. The results of this prospecting have been presented in reports by Powell Duffryn Technical Services Limited (1950) and Shepherd (1951).

Because of weathering of the top of the seam in the first shaft, the Department of Mines, in collaboration with the Bureau of Mineral Resources, was responsible for sinking a second shaft in 1956 so that samples of coal at greater depth could be obtained for testing by the Coal Research Section of the Commonwealth Scientific and Industrial Research Organisation. The section in this shaft was, however, affected by faulting.

The only production from this field took place in 1949 when the Mackay City Council operated a temporary open-cut during a strike. Due to proximity to the crop, most of the coal produced was partly weathered.

Following this, active interest in the area lapsed till 1957 when the area immediately south of the proved reserves was geologically mapped by the Geological Survey for the purpose of locating the southerly extension of the seam (Tweedale, 1958). In January 1959, New Consolidated Goldfields (Australasia) Proprietary Limited was granted twenty-three Coal Mining Leases (Numbers 94 to 116), which included the previously proved open-cut reserves and their presumed extensions to the north-west and south-east.

By agreement between the company and the Department of Mines, a series of thirty holes was drilled by the Drilling Branch of the Department to prospect these presumed extensions of the Elphinstone Seam and also to check certain parts of the areas previously drilled, where information was either scanty or unreliable. The company was responsible for geological services in the field and for location of boresites by alidade and plane table survey. The Geological Survey was responsible for examination and sampling for analysis of coal sections.

The Departmental drilling, comprising thirty holes ranging up to 405 ft. in depth, occupied the period 4th March to 8th December, 1959. Aggregate footage drilled was 6,236 ft. 7 in. A Mindrill F20 rig was employed on a one-shift basis.

The following plans and diagrams illustrate this report:—

(1) Locality Plan. (Figure 1).
(2) Plan of the Nebo Coalfield showing leases, boreholes and the outcrop of the Elphinstone Seam. (Figure 2).
(3) Geological Map of the Kemmis Creek South Area. (Figure 3).
(4) Generalised bore sections (Figures 4A-C).
(5) Diagrams of the Elphinstone and Hynds Seams showing details of core recovered, sections sampled, and results of analyses. (Figures 5A-D).

PREVIOUS LITERATURE

The earliest published reference to coal outcrops in the area was by Jack (1887). Subsequently Gibb Maitland (1889) described other outcrops and Cameron (1905) mapped part of the area. Ball (1909) observed an outcrop of the seam which has recently been drilled. Reid (1925) also mapped part of the area. Later Reid mapped the coalfield in greater detail and in his report (1946) discussed all previous literature, listing the then known occurrences of coal. The results of the diamond drilling carried out under the direction of J. H. Reid for Power and Traction Finance Company Limited and Electric Supply Corporation (Overseas) Limited were given in a report by Powell Duffryn Technical Services Limited (1950), consultants to Power and Traction Finance Company Limited. The results of the later drilling, financed by the Department of Mines, were assessed by Shepherd (1951). The carbonising properties of coal from No. 2 Trial Shaft in the Kemmis Creek Area were evaluated by the Coal Research Section of the Commonwealth Scientific and Industrial Research Organisation (1957). A geological map of the Kemmis Creek South Area, with an accompanying report, was prepared by Tweedale (1958). The results of the recently completed (1959) drilling campaign were set out in a company report by Dimmick (1960) who had represented New Consolidated Goldfields (Australasia) Proprietary Limited in the field during the drilling.

REGIONAL GEOLOGY

The coal-bearing beds of the Nebo Coalfield form part of the upper coal measures of the Bowen Basin (Reid, 1925). They lie conformably on Middle Bowen Marine Beds and are, in turn, succeeded with apparent conformity by the Carborough Sandstone of probably Triassic age. Basalt, which overlies the coal measures in some places, is presumably of Tertiary age.

Reid divided the coal measures provisionally into two formations. The older one he named Fort Cooper Coal Measures and the younger, Elphinstone Coal Measures. The Fort Cooper Coal Measures were described as brown limonitic sandstone and brown fossiliferous shale, interbedded with white cherty shale, and containing some coal seams. The lithology of the Elphinstone Coal Measures was described as yellow to grey sandstone and shale with coal seams and at least one bed of conglomerate. Both provisional formations contained *Glossopteris* and fossil wood.

Dimmick (1960) considered that there was a wide transitional zone between these provisional formations and observed white cherty shale in the Elphinstone Coal Measures.

As a result of recent drilling, the coal measures are known to be intruded by basic dykes, one of which has destroyed the Elphinstone Seam in parts of the Kemmis Creek South Area.

STRUCTURAL GEOLOGY

Reid interpreted the geological structure of the area as a series of gentle folds with a general regional dip of the strata to the south-west. Tweedale (1958) suggested that the structures mapped by Reid comprised series of smaller parallel or "en echelon" folds and that "in general, the beds dip to the west-south-west with some monoclinal folding and local reversals of dip".

The Elphinstone Seam has been displaced by a major fault zone which is exposed in the Isaacs River at the north-western end of the Lake Elphinstone Area. The full width of this zone has not been determined as the most northerly drillhole (N.S. 27) was drilled in faulted strata. Other faults known to occur in the drilled areas are of a minor nature and would not be likely to have a serious effect on mining operations

RESULTS OF DRILLING

(a) The earlier (1948-1950) series of drillholes

Reid (1946) selected three outcrops which he considered should be prospected. A drilling programme, commenced in 1948, tested two of these, in Waterfall and Bee Creeks, and showed that they represented the same seam (Elphinstone Seam). The third outcrop, in Coal Gully, has not been accurately located. It is probably the Elphinstone Seam but may be another, lower seam.

In this first drilling campaign, eighteen holes (Nos. 2 to 6, 7A-B, 8A-B, and 9 to 17) were drilled in the northern part of the field (Lake Elphinstone Area). The remainder (Nos. 1 and 18 to 28) were drilled further south in the Kemmis Creek Area (Figure 2). The results of the drilling in the Lake Elphinstone Area were presented in an unpublished report (Powell Duffryn Technical Services Limited, 1950) in which reserves of coal suitable for open-cut extraction and with a maximum of 150 ft. overburden were estimated to be of the order of 16,000,000 tons. No topographic survey of the proposed open-cut area was made.

In a report on the Kemmis Creek Area, where the latter part of the drilling and the sinking of a test shaft were financed by the Department of Mines, Shepherd (1951) estimated reserves of open-cut coal with overburden between 25 ft. and 150 ft. as 7,000,000 tons. A topographic survey of this area was available for calculation of reserves.

Between the Lake Elphinstone and Kemmis Creek Areas, which are approximately three and a half miles apart, the seam dips more steeply and consequently this part of the field was excluded from the drilling programme. This steepening of dip was reported at bore No. 1, the most northerly hole in the Kemmis Creek Area. Also, in this hole, the thickness of coal was reported to have decreased to 10 ft. 3 in.

(b) The later (1959) series of drillholes

When drilling in the Nebo Coalfield was discontinued in 1950, limits of reserves to the south-east had not been established; also, at the north-western end of the Lake Elphinstone area, the seam was cut off by a major fault zone and no attempt had been made to trace the seam further in this direction. The objects of the drilling campaign commenced in 1959 were to trace the crop of the seam further to the north-west and south-east and extend the open-cut reserves in these directions. For convenience, the new areas drilled have been named Lake Elphinstone North and Kemmis Creek South Areas respectively. In addition, one hole was drilled in the Lake Elphinstone Area and two in the Kemmis Creek Area to supplement the earlier programmes. Bore sites were selected by the field representative of New Consolidated Goldfields (Australasia) Proprietary Limited.

(i) **The Kemmis Creek South Area.**—In addition to the Elphinstone Seam, three coaly sections were drilled in the Kemmis Creek South Area (Figure 4A). The highest of these is a thin, unnamed seam lying about 200 ft. above the Elphinstone Seam. It was drilled in only one borehole (N.S. 18). The second comprises a thick section of carbonaceous shale with thin coal lenticles which was penetrated in N.S. 2, 3 and 5. This section underlies the Elphinstone Seam at an interval of approximately 140 ft. The third coaly section has been named the Hynds Seam (Dimmick, 1960). It lies approximately 225 ft. below the Elphinstone Seam and was intersected in N.S. 5. A seam in a similar stratigraphic position was also intersected in N.S. 13.

Drilling commenced at N.S. 1 approximately 20 chains south-south-westerly from bore No. 25 of the earlier series. The Elphinstone Seam was approximately 21 ft. 9 in. thick and comparatively clean in this hole (Figure 5A). There was however, a thin banded section approximately 5 ft. from the top of the seam. In this hole, a fine-grained basic intrusion, vesicular in places, was penetrated approximately 60 ft. above the seam. Boreholes N.S. 2, 3 and 4 were located up-dip from the crop of the Elphinstone Seam. In N.S. 5 the Elphinstone Seam was penetrated at shallow depth. The seam closely resembled that cored in N.S. 1 except that the thin banded section within the seam

in that hole had deteriorated to a predominantly shale band approximately 4 ft. thick in N.S. 5. The unnamed and Hynds Seams which underlie the Elphinstone Seam were also drilled in N.S. 5 but neither was sufficiently thick to warrant further investigation for open-cut reserves. The Hynds Seam appears, however, to be suitable for underground development (Figure 5A).

In all except one (N.S. 10) of the holes in the group south of N.S. 5 the Elphinstone Seam, where penetrated, was partly or wholly destroyed by the igneous intrusion which immediately overlies the seam in N.S. 6 and progressively transgresses it from roof to floor between there and N.S. 9. In N.S. 10 the intrusion occurs about 140 ft. below the Elphinstone Seam. In N.S. 11 a seam, which is apparently the Elphinstone Seam, has also been intruded, but the exact relationship of this intrusion to that penetrated in the earlier holes is not known.

In addition to being intruded, the Elphinstone Seam showed deterioriation due to banding in the area south of N.S. 6 (Figure 4A). A series of boreholes (N.S. 12 to 21), which tested the Elphinstone Seam further south (Figure 3) penetrated similarly banded sections of the Elphinstone Seam (Figures 5A-C). These sections are unsuitable for open-cutting, but would be workable by underground mining.

Correlation of the seam drilled in N.S. 19 with the Elphinstone Seam (Figures 3, 4B) has been based by the writer on the attitude of the strata in the vicinity and on comparison of seam sections, and consequently the alternative correlation of a thin seam, less than 3 ft. thick, drilled in N.S. 18 with the Elphinstone Seam has been rejected. The seam in N.S. 18 probably lies about 200 ft. above the Elphinstone Seam. It is of no economic importance at present.

In N.S. 13, a heavily banded seam which is almost certainly the Hynds Seam, was drilled between 140 ft. and 188 ft. Only a small part of this seam may be of suitable quality and thickness for underground exploitation.

(ii) **The Kemmis Creek Area.**—Of two holes drilled in the Kemmis Creek Area to supplement the earlier boring programme, one (N.S. 29) intersected a section of the Elphinstone Seam 25 ft. thick, including minor bands. The thickness of the seam in this hole suggests that due to weathering the full section may not have been present in bore No. 1 where the seam was reported to be only 24 ft. from the surface and 12 ft. thick, including bands of shale totalling 1 ft. 9 in. Dips ranging up to 20 degrees measured on core from N.S. 29 confirm previous reports of steeper dips in the area between boreholes 1 and 15 of the 1948-1950 series.

The second borehole, N.S. 30, did not intersect the Elphinstone Seam, but penetrated faulted strata at its expected depth. The absence of the Elphinstone Seam in this hole is almost certainly due to normal faulting.

(iii) **The Lake Elphinstone Area.**—One borehole, N.S. 28, was drilled between bores 11 and 16 because of low core recovery in these holes. The thickness of the seam in N.S. 28 was 14 ft. which is comparable with its thickness elsewhere in the Lake Elphinstone Area. Core recovery in the seam was 92 per cent.

(iv) **The Lake Elphinstone North Area.**—Drilling in this area commenced at N.S. 22, which was located 390 ft. from borehole No. 14. This hole was drilled to a depth of 394 ft. 6in. to establish the geological succession in the area as an aid to correlation of strata drilled in later holes. Of particular interest in this regard was the conglomerate beneath the Elphinstone Seam, the significance of which as a marker bed was first noticed by Reid (1946). In N.S. 22 this conglomerate was approximately 37 ft. below the Elphinstone Seam.

The next hole, N.S. 23, entered faulted shale at a depth of 93 ft. and from there to the bottom of the hole (281 ft. 5 in.) penetrated steeply dipping and faulted strata. Neither the Elphinstone Seam nor the conglomerate was penetrated. The Company Geologist, from the attitude of the strata above the faulted zone, formed the opinion that the beds had been dragged to the north-east, and four holes (N.S. 24 to 27) were drilled north of the Isaacs River in an unsuccessful attempt to locate the Elphinstone Seam in that area (Figure 2). The last of these (N.S. 27), located approximately a mile and three-quarters north-westerly from N.S. 23, was still in the faulted zone.

NATURE OF COAL

The coal is predominantly durain with minor proportions of vitrain and fusain which normally occur as lenticles. In the Kemmis Creek South Area, both Elphinstone and Hynds Seams contain coal of low volatile bituminous rank. The Elphinstone Seam in N.S. 22 and 28 (Lake Elphinstone Area) and N.S. 29 (Kemmis Creek Area) was of slightly lower (medium volatile bituminous) rank. Ash content of the Elphinstone Seam is of the order of 20 per cent. In the two boreholes, N.S. 1 and N.S.5, which proved additional reserves, ash contents of the seam were 21·4 per cent. and 19·8 per cent. respectively. Coking properties of samples from the comparatively shallow bores and shafts show considerable range. Some samples were classified as medium coking, others as weakly coking or agglomerating. Coke produced ranged from physically weak to good quality dull black coke. Swelling index of the samples ranged generally between 1 and 4½ with a few higher values (Figures 5A-D). The coal is considered suitable for blending with strongly coking coal for production of metallurgical coke (C.S.I.R.O., 1957). No information is available concerning the coking properties of this coal at greater depth.

RESERVES OF COAL

Reserves of open-cut coal proved by the 1948-50 series of boreholes were estimated at 16,000,000 tons (0 ft.–150 ft. overburden) in the Lake Elphinstone Area (Powell Duffryn Technical Services Limited, 1950) and 7,000,000 tons (25 ft. –150 ft. overburden) in the Kemmis Creek Area (Shepherd, 1951).

Accurate calculation of overburden depth was not possible in the Lake Elphinstone Area for which no contour plan was available; also, no allowance was made in the estimate of reserves in that area for partially weathered coal adjacent to the crop. Average thickness of seam was reported to be 14 ft. in the Lake Elphinstone Area and 25 ft. 6 in. in the Kemmis Creek Area; therefore, maximum overburden to coal ratios for estimated reserves in the two areas are 11 to 1 and 6 to 1 respectively.

Additional reserves of open-cut coal were proved in the Kemmis Creek South Area where N.S. 1 and N.S. 5 penetrated sections of the Elphinstone Seam of workable quality and thickness. These additional reserves are limited to the south-east by an area of heavily banded and intruded coal. Still further to the south-east, the Elphinstone Seam, although unsuitable for open-cut mining, may be workable by underground methods. Deeper drilling would be required, however, to establish reserves.

Boreholes N.S. 22 and 28, in the Lake Elphinstone Area, confirmed results of the earlier drilling without adding to the estimated reserves. Borehole N.S. 29 in the northern part of the Kemmis Creek Area penetrated a section of the Elphinstone Seam 25 ft. 6 in. thick. However, dips of up to 20 degrees measured on core from this hole indicate that the seam is dipping too steeply for open-cut mining but not for underground mining.

Where tested in the Kemmis Creek South Area, the Hynds Seam was not sufficiently thick for open-cut extraction but it also would merit consideration in any programme of drilling to prove reserves for underground mining.

In estimating the additional reserves south-east of borehole 25 proved by N.S. 1 and 5, 25 ft. has been arbitrarily selected as minimum depth of overburden. No precise information is available concerning depth of weathering, which appears to be variable throughout the area. Coal from a shallow depth in N.S. 5 was of good quality, but, in test shaft No. 1, the coal was at least partly weathered to a depth of 47 ft. The upper limit of overburden of 150 ft. used in previous estimates has also been used in the Kemmis Creek South Area. Because no contouring of the surface has been done, boundaries of the proved reserves must, of necessity, be approximate only. The southern limit of additional reserves has been drawn half-way between N.S. 6 and a line joining N.S. 1 and N.S. 5. The area of reserves defined by these limits is 40 acres, within which average vertical thickness of coal calculated from reported thicknesses in boreholes 25 and 28 and from coal actually cored in N.S. 1 and N.S. 5 is 21·3 ft. Average specific gravity of coal in the Elphinstone Seam in N.S. 1 and N.S. 5 is 1·47. Reserves of coal calculated from these data are approximately 1·5 million tons. Overburden to coal ratio ranges up to 7 to 1.

CONCLUSIONS

The objects of the 1959 drilling programme were to extend to the north and south open-cut reserves of coal proved by the previous programme. The results were disappointing in that the only additional reserves proved were one and a half million tons between borehole 25 and an intruded area to the south. Still further south the seam was split by shale bands and unsuitable for open-cut mining. In the north, the Elphinstone Seam could not be traced across a wide faulted zone.

The combined results of the two drilling programmes suggest, however, that much greater reserves would be available in the Elphinstone Seam for mining by underground methods, which, on present evidence, appears to be possible along almost the whole of the known length of its outcrop (approximately 16 miles), except for the intruded area between N.S. 6 and N.S. 11. Deeper drilling to delineate any deteriorated or intruded areas would, however, be required before commencement of any such programme of underground development.

Also of interest for underground mining is the Hynds Seam which would similarly require deeper drilling.

23rd March, 1961.

REFERENCES

BALL, L. C., 1909: Discovery of coal in the Mackay District. *Qld Govt Min. J.*, 10, 532.

CAMERON, W. E., 1905: The Central Queensland (Dawson-Mackenzie) Coal Measures. Their continuation towards Mackay and Nebo Districts. *Geol. Surv. Qld Publ.*, 200.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, COAL RESEARCH SECTION, 1957: Nebo Coalfield, Queensland. Evaluation of carbonising properties of coal from No. 2 Trial Shaft in the Kemmis Creek area. Unpublished report.

DIMMICK, T. D., 1960: Test drilling of Elphinstone Seam, Nebo District, North Queensland. Unpublished report to New Consolidated Goldfields (Australasia) Pty. Ltd.

JACK, R. L., 1887: On the geological features of the Mackay District. *Publ.*, 39. (Repeated in *Geol. Surv. Qld Publ.*, 92.)

MAITLAND, A. GIBB, 1889: Geological observations at the heads of the Isaacs, the Suttor, and the Bowen Rivers. *Geol. Surv. Qld Publ.*, 54.

POWELL DUFFRYN TECHNICAL SERVICES LIMITED, 1950: Interim report on the drilling carried out in the neighbourhood of Lake Elphinstone, near Nebo. Unpublished report to Secretary for Mines and Immigration.

REID, J. H., 1925: The Permo-Carboniferous Coal Measures, &c., of the Nebo District. *Qld Govt Min. J.* 26, 465-474.

————, 1946: Geological Reconnaissance of the Nebo District coal areas. *Qld Govt. Min. J.*, 47, 10-13.

SHEPHERD, S. R. L., 1951: Test drilling on the Nebo Coalfield. *Qld Govt. Min. J.*, 52, 51-61.

TWEEDALE, G. W., 1958: Probable extension of the coal seam, Upper Kemmis Creek, Nebo. Unpublished report to Chief Government Geologist, Geological Survey of Queensland.

S. G. REID, Government Printer, Brisbane

FIG. 1

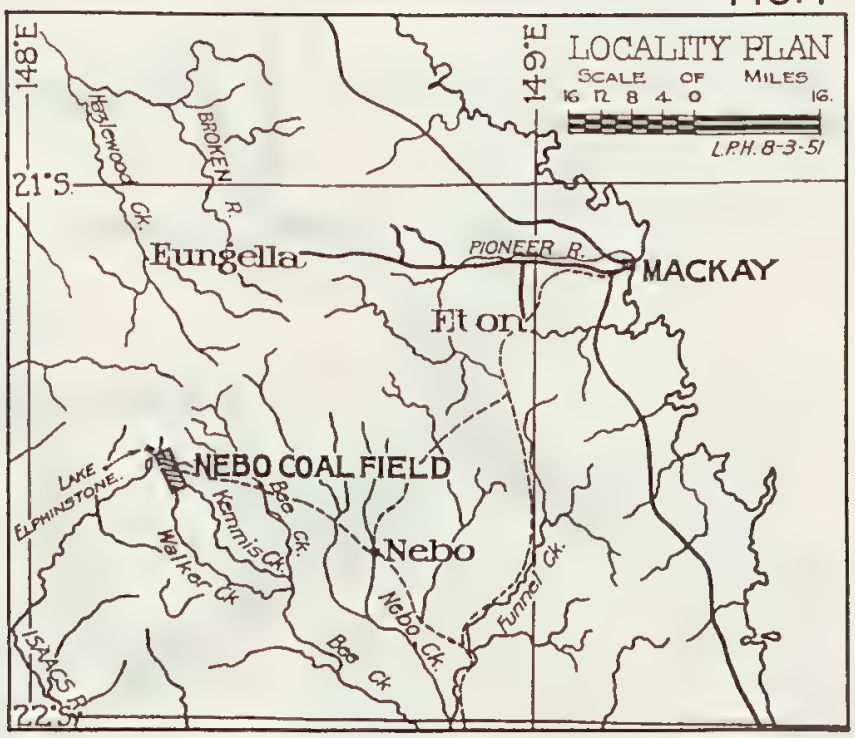
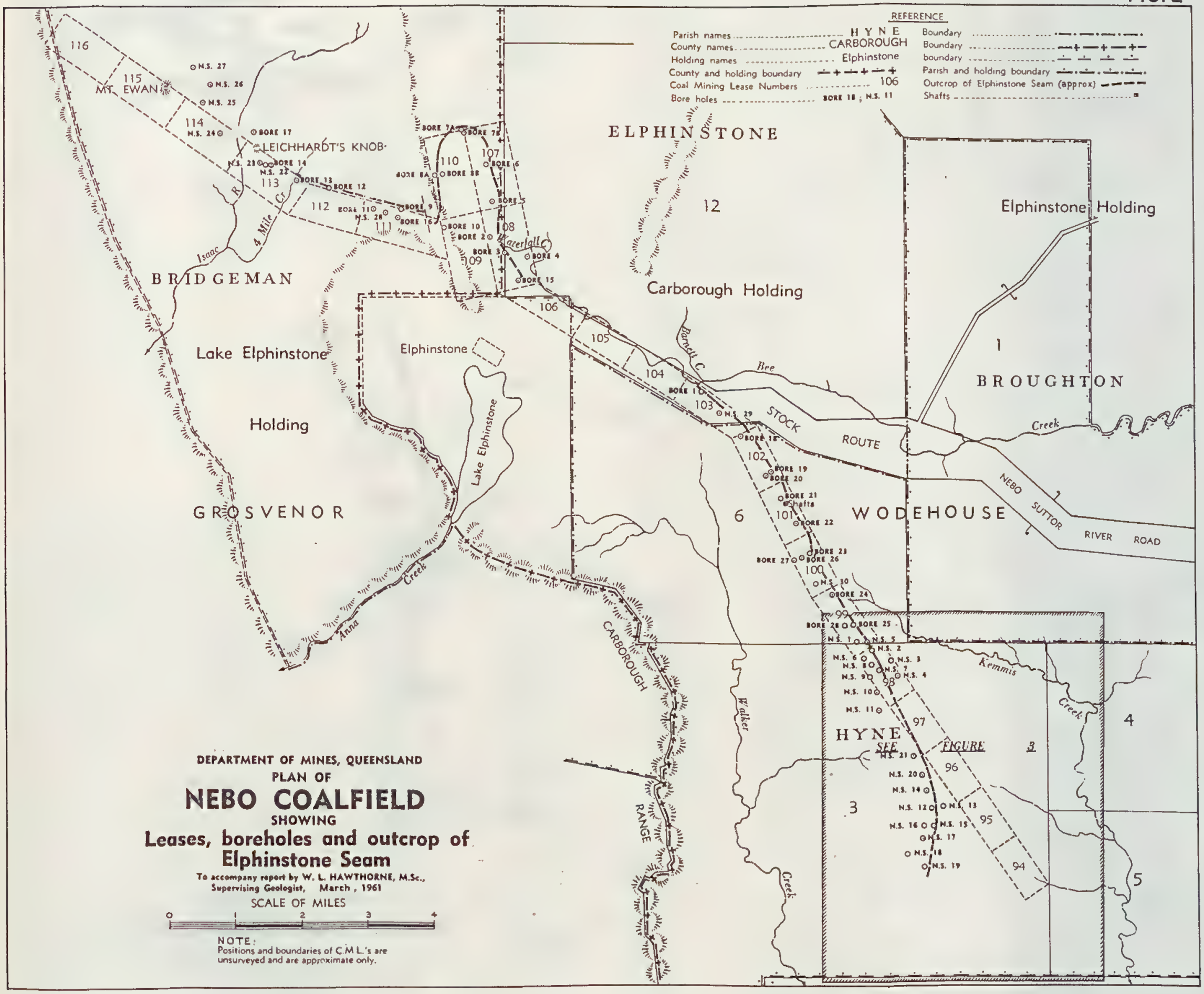

LOCALITY PLAN
SCALE OF MILES
16 12 8 4 0 16.
L.P.H. 8-3-51
148°E
149°E
21°S
22°S
Eungella
PIONEER R.
MACKAY
Eton
NEBO COAL FIELD
Nebo
LAKE ELPHINSTONE
Kennis Ck.
Walker Ck.
Bee Ck.
Nebo Ck.
Tunnel Ck.
ISAACS R.
BROKEN R.
Hazlewood Ck.

FIG. 2



DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

NEBO COALFIELD

SHOWING

Leases, boreholes and outcrop of Elphinstone Seam

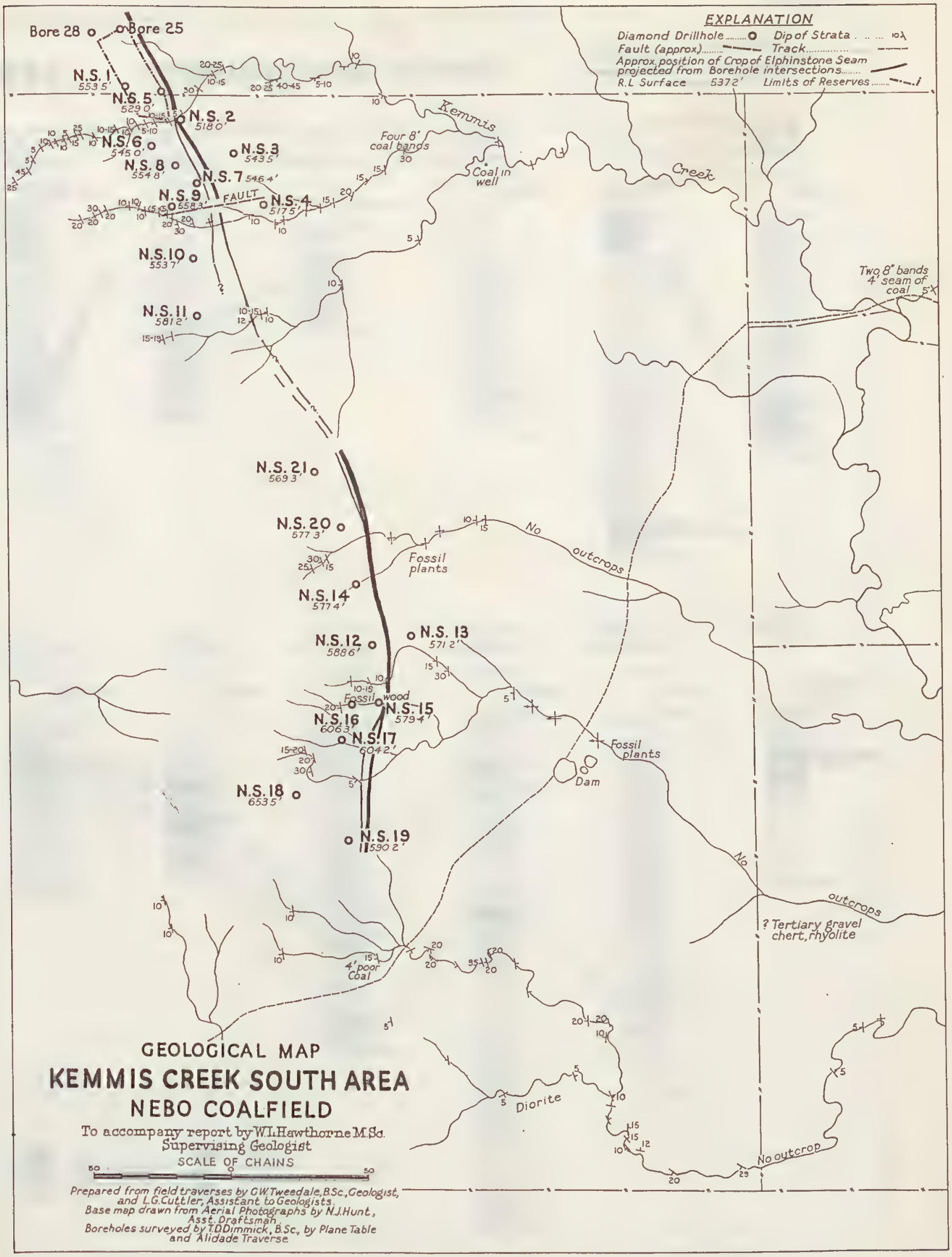
To accompany report by W. L. HAWTHORNE, M.Sc., Supervising Geologist, March , 1961

SCALE OF MILES

0 1 2 3 4

NOTE:
Positions and boundaries of C.M.L.'s are unsurveyed and are approximate only.

FIG. 3



GEOLOGICAL MAP
KEMMIS CREEK SOUTH AREA
NEBO COALFIELD

To accompany report by W.L. Hawthorne M.Sc.
Supervising Geologist

SCALE OF CHAINS
50 0 50

Prepared from field traverses by G.W. Tweedale, B.Sc., Geologist, and L.G. Cuttler, Assistant to Geologists.
Base map drawn from Aerial Photographs by N.J. Hunt, Asst. Draftsman
Boreholes surveyed by T.D. Dimmick, B.Sc., by Plane Table and Alidade Traverse

FIG. 4A

NEBO GENERALISED BORE SECTIONS

VERTICAL SCALE OF FEET
50 0 100

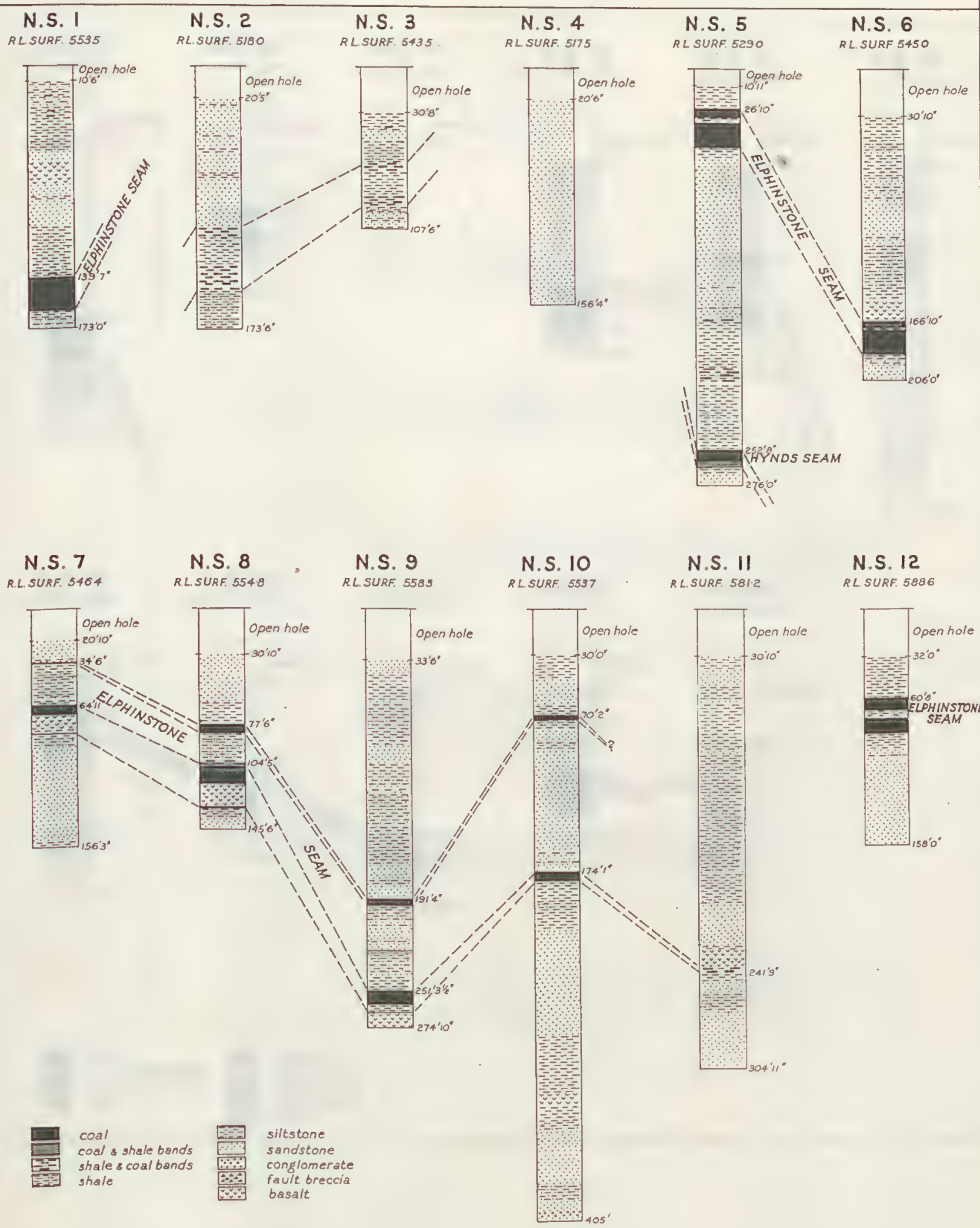


FIG. 4 B

NEBO GENERALISED BORE SECTIONS

VERTICAL SCALE OF FEET
50 0 100

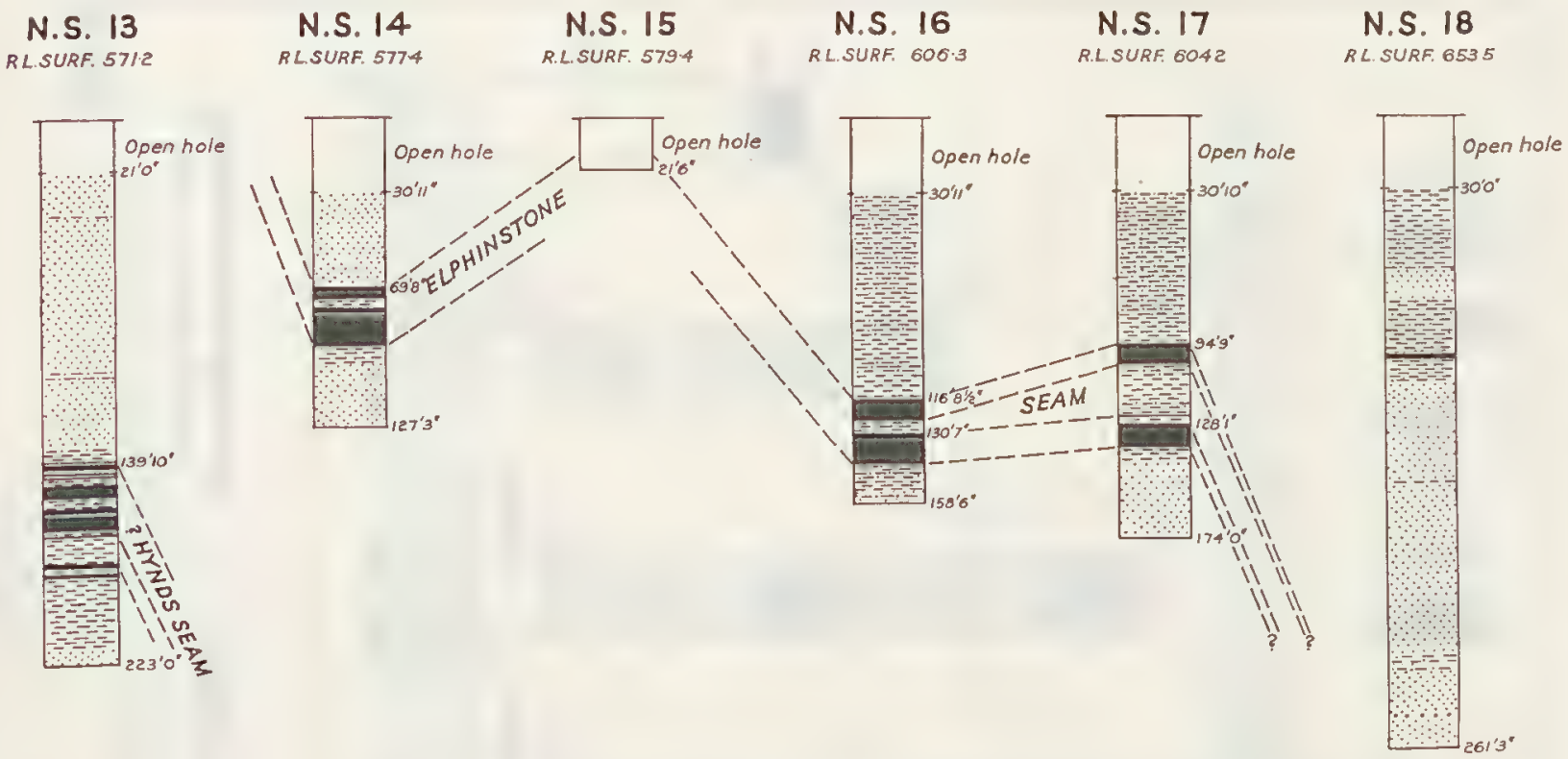


FIG. 4c

NEBO GENERALISED BORE SECTIONS

VERTICAL SCALE OF FEET
50 0 100

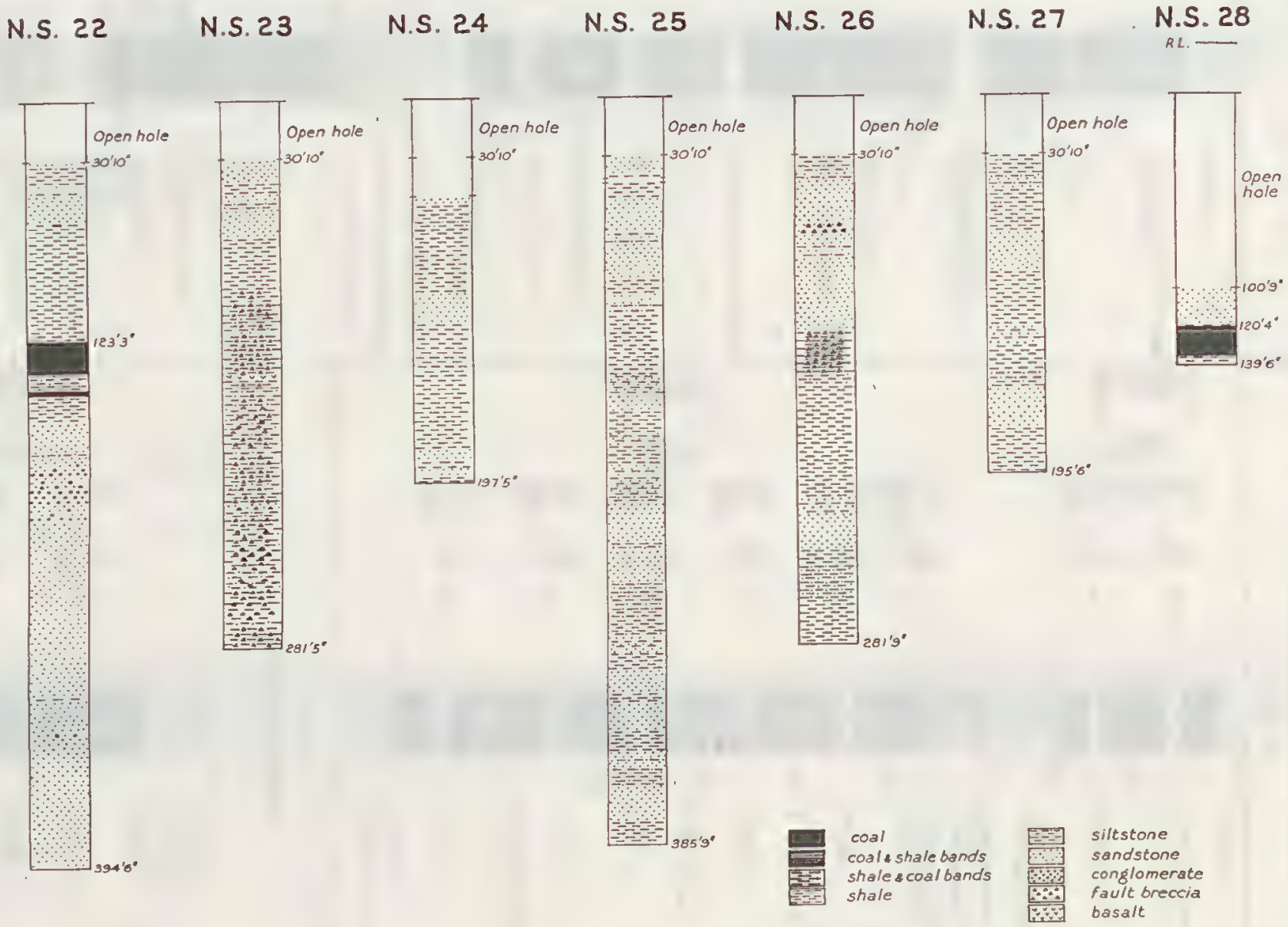


FIG. 5 A

NEBO — DIAGRAMS OF ELPHINSTONE SEAM (AND HYNDS SEAM IN N.S.5)

DETAILS OF CORE RECOVERY AND ANALYSES

N.S. 1

Results of Analysis	Recovery per cent	Section Sampled	Description
		138'1"	
			1'6" gy sh,
		139'7"	
M 1·0 VM 19·4 FC 49·5 A 30·1 Coking tests Class Af Sw I 1 Agg val 6	96·1%		
			2'1" coal – upper half dull with calcite veins;
M 1·2 VM 17·8 FC 66·5 A 14·5 Coking tests Class Af Sw I 2½ Agg val 10	94·4%	141'9"	
			2'10" coal;
		144'9"	
M 1·5 VM 15·4 FC 49·5 A 33·6 Coking tests Class Af Sw I 1 Agg val 5	66·7%		
			2'0"(bkn) coal with broken sh. fragments throughout;
M 1·1 VM 17·2 FC 68·1 A 13·6 Coking tests Class Af/Cw Sw I 2 Agg val 8	100%	147'9"	
			1'4" coal;
		149'1"	
			1" coal; 2½" dk gy sh;
M 1·1 VM 18·0 FC 62·1 A 18·8 Coking tests Class Af/Cw Sw I 3 Agg val 10	94·4%		
			2'6½" coal w calcite veins,
		152'1"	
M 1·2 VM 17·0 FC 61·4 A 20·4 Coking tests Class Af Sw I 1½ Agg val 8	83·3%		
			2'6"(bkn) coal with thin sh bands;
		155'1"	
M 1·0 VM 17·9 FC 63·8 A 17·3 Coking tests Class Cw Sw I 4 Agg val 11	83·3%		
			2'6" coal;
		158'1"	
			2½" sheared coaly sh;
M 1·1 VM 16·3 FC 61·4 A 21·2 Coking tests Class Cw Sw I 1½ Agg val 7	84·6%		
			2'6½" coal – slickensided;
		161'4"	
			2" coaly sh

Composite: M 1·2 VM 16·7 FC 60·7 A 21·4 Joules/gm 26,890 BTU/lb 11,570 S 0·29 SG 1·481 Coking tests Class Af Sw I 2 Agg val 8

N.S. 12

Results of Analysis	Recovery per cent	Section Sampled	Description
		58'6"	
			1'7½" gy sh – dk gy sh at base;
			6" carb sh. with coal lents.;
		60'7½"	
			1'2" inf. coal,
M 1·3 VM 14·8 FC 71·8 A 12·1 BTU/lb 13,270 S 0·42 SG 1·384 Coking tests. Class Af Sw I 2	96·4%		
			3'3" coal;
M 1·2 VM 18·6 FC 64·8 A 15·4 BTU/lb 12,500 S 0·23 SG 1·418 Coking tests: Class Cw/Cm Sw I 4½	100%	65'2½" 65'4½"	1½" dk gy.sh.; ½" carb sh; 1'1½" coal;
65'2½"-65'4½" and 66'6-66'9½": A 79·4 S.G 2·461		66'6" 66'9½"	3½" dk gy. slts., 5½" coal;
M 1·2 VM 17·3 FC 70·2 A 11·3 BTU/lb 13,400 S 0·34 SG 1·361 Coking tests Class Cm Sw I 7	100%	67'3"	5½" coal; 2½" carb.sh, 1'2" dk gy. sh., 1'7" (part bkn.) gy.sh., 5" dk gy.sh.;
		67'8½"	1'3½" carb.sh.w coal lents; 7" carb sh.; 1" dk. gy. sh; 8" inf. coal w. few coal lam.; 6" dk. gy. slts.; 4" carb.sh.;
		75'1½"	9½" inf. coal;
		76'0"	
M 1·4 VM 15·5 FC 64·5 A 18·6 BTU/lb 10,190 S 0·39 SG 1·449 Coking tests Class Af Sw I 2	93·8%		4'3" inf. coal – coal with few carb. sh. laminae
		80'6"	
M 1·9 VM 14·3 FC 49·1 A 34·7 BTU/lb 9540 S 0·37 SG 1·586 Coking tests Class Af Sw I 2	97·6%		¾" dk gy/carb sh., 6" inf. coal – coal w few cb.sh lam., ½" dk gy sh, 3" coal, ½" dk gy sh, 1" coal; ½" dk gy sh, 11" inf. coal – coal w few cb sh lam; 1¼" dk gy. sh.; 1'2" inf. coal – coal;
		83'11½"	2½" (bkn) gy sh,
		84'6"	1½" (p bkn) carb. sh. w coal lents.

N.S. 5

Results of Analysis	Recovery per cent	Section Sampled	Description
		26'3"	
			7" dk gy. sh;
		26'10"	
Composite M 1·7 VM 16·1 FC 69·2 A 13·0 BTU/lb 12,960 S 0·39 SG 1·410 Coking test Class Af			
M 1·8 VM 16·6 FC 69·2 A 12·4 Coking tests Class Af Sw I 1	84·8%		2'4" coal – dull in places;
M 1·3 VM 16·4 FC 68·6 A 13·7 Coking tests Class Af Sw I 1/4	82·7%	29'7"	1'9½" coal;
		31'9"	
		31'10"	
		32'2"	2'2" (bkn) gy. sh. – dk gy sh in blm 4;
		33'11"	3" carb. sh. w coal lents, 3" inf coal,
			9½" (p b) gy/dk gy. sh – sheared;
		35'5½"	4½" (p b) carb sh. w. num. coal lents. – inf. coal; ½" gy.sh; 3" dull coal;
M 1·5 VM 14·8 FC 45·3 A 38·4 Coking tests Class Af Sw I 1½	91·4%	36'11"	8" coal;
M 1·2 VM 16·4 FC 59·8 A 22·6 Coking tests Class Af/Cw Sw I 2½	88·5%		2'4½" coal;
		39'10"	1½" dk gy.sh; 1" coal;
M 1·2 VM 15·6 FC 64·7 A 15·6 Coking tests: Class Cw Sw I 3	91·7%		2'9" coal,
Composite: M 1·2 VM 16·5 FC 60·5 A 21·8 BTU/lb 11,400 S 0·31 SG 1·481 Coking test: Class Cw		42'10"	4" coal; ½" gy.sh;
M 1·3 VM 16·2 FC 64·8 A 17·7 Coking tests Class. Af Sw I 2	82·0%		2'1" coal;
M 1·2 VM 16·8 FC 60·0 A 22·0 Coking tests: Class Cw Sw I 4	86·1%	45'10"	1'11½" coal;
			1½" l gy/fn. sh, 6" coal,
		48'10"	2½" (b) inf. coal, 1½" dk gy.sh.;
M 1·4 VM 15·8 FC 60·5 A 22·3 Coking tests Class Af Sw I 2½	85·9%		2'3" coal;
		52'1"	2½" inf. coal,
			1'4" dk gy sh – slts near base.
		53'8"	

N.S. 5 HYNDS SEAM

Results of Analysis	Recovery per cent	Section Sampled	Description
		250'7"	
			6" dk gy sh,
			8½" carb. sh;
			10½" dk gy sh,
		252'8"	3½" carb. sh. w num. coal lents. – inf. coal;
M 1·4 VM 16·2 FC 58·2 A 24·2 Coking Tests: Class Af/Cw Sw I 3	100%		3'4½" coal;
Composite: M 2·0 VM 14·7 FC 49·9 A 33·4 BTU/lb. 9590 S 0·81 SG 1·589 Coking test Class Af		256'4"	6" coal; 1" (p b) dk. gy. sh.;
M 1·7 VM 14·3 FC 59·8 A 24·2 Coking tests: Class Af Sw I. 2	89·4%		2'0½" (p b) coal;
		259'4"	6½" coal;
M 3·3 VM 12·4 FC 20·9 A 55·4 Coking Tests: Class. Aw Sw I 1	92·6%	259'10½"	3" (b) carb. sh. w coal lents; 1" (p b) dk gy sh; 2" inf. coal; 2" (b) carb sh; 3" brn sh;
M 2·9 VM 10·9 FC 27·2 A 59·0 Coking Tests: Class Aw Sw I. 1	96·4%	262'1½"	5" (b) sh. & coal; 2" (b) coal; 3½" (p b) brn sh; 3" (b) coal w. some carb. sh; 1" (p b) dk gy. sh; 1" coal; 1½" carb sh.
		262'4"	½" brn. sh; 1½" carb. sh. w coal lents;
		263'3½"	8" (v bkn) carb. sh w. some coal; 3½" (bkn) dk gy. & carb. sh, 1'9" dk gy./carb. sh. w. few coal lents. & lam.
		265'4"	

Composite: M 1·2 VM 16·7 FC 60·7 A 21·4 Joules/gm 26,890 BTU/lb 11,570 S 0·29 SG 1·481 Coking tests Class Af Sw I 2 Agg val 8

NEBO

DIAGRAMS OF ELPHINSTONE SEAM

DETAILS OF CORE RECOVERY AND ANALYSES

Results of Analysis	Recovery per cent	Section Sampled		Description

N.S. 14

Results of Analysis	Recovery per cent	Section Sampled		Description
M% 1·4 VM% 17·2 FC% 61·3 A% 20·1 BTU/lb 11,420 S% 0·37 SG 1·462 Coking tests Class Af Swl. 2	84·3%	65'6"	3'11" gy/wh f sa;	
		69'8"	3'7" (pb) coal;	
		73'11"	74' 1" gy sh,	
			3'6" gy sh w few coal lents.;	
		77'6"	1'2" gy sh,	
			1½" carb sh,	
			1'1" inf coal/coal,	
			4" inf coal; 2" dk gy/carb sh;	
			8½" (pb) inf coal,	
			11½" gy sh impreg. w iron carb in top 3½";	
		82'6½"	1'0" v inf. coal — carb sh in places;	
M% 1·5 VM% 15·2 FC% 60·3 A% 23·0 BTU/lb 11,270 S% 0·39 SG 1·483 Coking tests Class Af Swl ½	98·6%		9½" coal,	
		84'6"	4'1" coal;	
		88'6"	1'4" carb. sh. w coal lents. & lam. — inf. coal in few places;	
M% 2·2 VM% 13·8 FC% 44·2 A% 39·8 BTU/lb 8,330 S% 0·28 SG 1·653 Coking tests Class Af Swl 1	96·7%		9" coal,	
			1½" dk gy. sh; 3" carb. sh;	
			11" coal — bkn. in top 3½";	
		92'0½"	1'2" dk gy/carb. sh. w coal lents & lam.	
		93'3"	1" gy sh,	

N.S. 16

Results of Analysis	Recovery per cent	Section Sampled		Description
		116'0"	3" dk gy sh;	
		116'8½"	5½" carb sh w coal lents — inf. coal;	
M% 1·4 VM% 15·7 FC% 72·0 A% 10·9 BTU/lb 13,490 S% 0·37 SG 1·374 Coking tests Class Af Swl. 2	97·1%		5'8" coal,	
122'6½"-122'11½" A% 79·5 SG. 2·417		122'6½"	5" gy. sh — carb sh. at btm;	
M% 1·8 VM% 28·6 FC% 64·4 A% 11·7 BTU/lb 13,350 S% 0·29 SG 1·370 Coking tests Class Cm Swl 5½	100%	122'11½"	1'3½" coal,	
		124'3"	1" carb sh; 3½" gy sh. — dk gy sh;	
		124'9"	3'7" gy. sh,	
			1'2" gy. slts,	
			1'2" gy — dk gy. sh;	
			7" v inf. coal;	
			8½" coal — inf. coal in places;	
			9" carb sh;	
			3" v. inf. coal;	
		133'4"	6" gy. slts;	
M% 1·5 VM% 14·8 FC% 62·3 A% 21·4 BTU/lb 11,580 S% 0·30 SG 1·480 Coking tests Class Af Swl 1	72·4%		1" gy. sh; 2" carb sh (pb);	
		134'5½"	6" coal;	
			6" (bkn) v inf. coal;	
			2'6" (p bkn) coal;	
M% 2·0 VM% 14·2 FC% 43·9 A% 39·9 BTU/lb 8,340 S% 0·32 SG 1·658 Coking tests Class Af Swl 1	74·7%	139'3½"	1" carb sh; 1½" coal; 1½" gy. slts; 5" coal; ½" dk gy. sh;	
			1'3" coal;	
		142'0"	1" dk gy/carb sh; 2" coal;	
		142'11"	5" (pb) coal;	
			8" (pb) gy. sh.	
		144'3"		

N.S. 17

Results of Analysis	Recovery per cent	Section Sampled		Description
		90'2"	3'5" gy sh,	
			8" dk gy sh;	
		94'9½"	5½" (b) carb sh w coal lents — inf. coal;	
M% 1·5 VM% 15·5 FC% 69·1 A% 14·9 BTU/lb 12,650 S% 0·49 SG 1·414 Coking tests: Class Af Swl. 1½	96·0%		4'2½" coal — inf. coal in places;	
		99'0"	1'10" coal — inf. coal in pl;	
101'1" - 101'4" A% 85·3 SG. 2·464		101'1"	3" gy. sh;	
M% 1·4 VM% 15·6 FC% 67·8 A% 15·2 BTU/lb 12,680 S% 0·37 SG 1·393 Coking tests. Class Af/Cw Swl 3	100%	101'4"	1'0½" coal,	
		102'4½"	3" dk gy sh. w. coal lam.;	
			4'10½" gy. sh. w. few slts lam.;	
		107'6"	8'6" gy sh. w. some slts. lam.;	
		116'0"	2'7" gy. sh;	
M% 1·7 VM% 14·3 FC% 61·1 A% 22·9 BTU/lb. 11,520 S% 0·38 SG 1·482 Coking tests. Class Af Swl 1½	95·6%	124'7"	6" inf. coal (bkn in btm 2") 2½" inf coal;	
			1'0" carb. sh;	
			10½" dk gy. sh. — faulted in btm. 2";	
		128'1"	11" carb. sh. w. coal lents;	
			5'0" coal — inf. coal in places w some carb. sh lam;	
M% 2·2 VM% 13·9 FC% 45·7 A% 38·2 BTU/lb 8640 S% 0·34 SG 1·625 Coking tests Class Af Swl. 1	100%	133'4"	5" coal, 3" carb. sh w coal lents. — inf coal in pl; 3½" coal;	
		133'9"	3" dk gy sh. w coal lam;	
			1'1" coal;	
			1" dk gy sh;	
			5½" coal; 1½" dk gy sh; 1½" coal;	
		136'5"	9½" dk gy sh. w coal lents. & lam. in top 4"	
			3'8" (pb) l gy sh;	
		142'		

FIG. 5 c

NEBO — DIAGRAMS OF ELPHINSTONE SEAM

DETAILS OF CORE RECOVERY AND ANALYSES

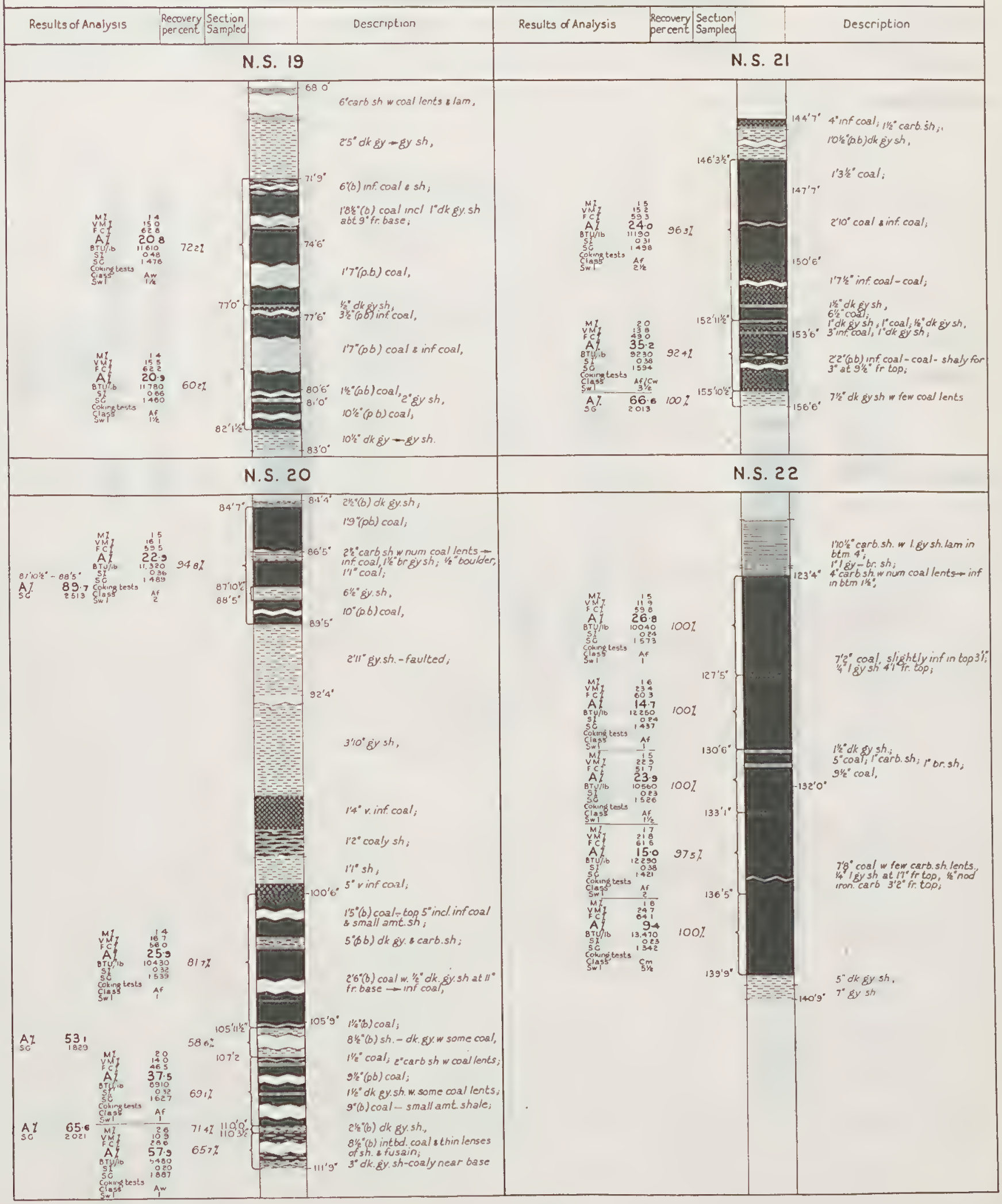

Results of Analysis
Recovery per cent
Section Sampled
Description
N.S. 19
68·0'
6" carb sh w coal lents & lam,
2'5" dk gy → gy sh,
71'9"
6"(b) inf. coal & sh;
1'8½"(b) coal incl 1" dk gy sh abt 9" fr. base;
74'6"
1'7"(p.b.) coal,
77'0"
½" dk gy sh,
3½"(p.b) inf. coal,
77'6"
1'7"(p.b) coal & inf coal,
80'6"
1½"(p.b) coal, 2" gy sh,
81'0"
10½"(p.b) coal,
82'1½"
10½" dk gy → gy sh.
83'0"
MI 1·4 VMI 15·5 FC 62·2 A 20·9 BTU/lb 11780 SI 0·86 SG 1·460 Coking tests Class Af Swl 1½ 60·2%
MI 1·4 VMI 15·0 FC 62·8 A 20·8 BTU/lb 11610 SI 0·48 SG 1·476 Coking tests Class Aw Swl 1½ 72·2%
N.S. 20
84'7"
84'4"
2½"(b) dk gy.sh;
1'9"(pb) coal;
86'5"
2½" carb sh w num coal lents → inf. coal, 1½" br gy sh; ½" boulder, 1'1" coal;
87'10½"
6½" gy. sh,
88'5"
10"(p.b) coal,
89'5"
2'11" gy.sh. – faulted;
92'4"
3'10" gy sh,
1'4" v. inf. coal;
1'2" coaly sh;
1'1" sh,
5" v inf coal;
100'6"
1'5"(b) coal – top 5" incl. inf coal & small amt. sh;
5"(p.b.) dk gy. & carb.sh;
2'6"(b) coal w. ½" dk. gy.sh at 11" fr. base → inf coal,
105'9"
105'11½"
1⅛"(b) coal;
8½"(b) sh. – dk. gy. w some coal,
107'2
1½" coal; 2" carb sh w coal lents;
9½"(pb) coal;
1½" dk gy.sh. w. some coal lents;
9"(b) coal – small amt. shale;
110'0"
110'3½"
2⅛"(b) dk gy. sh.,
8½"(b) int bd. coal & thin lenses of sh. & fusain;
3" dk. gy. sh-coaly near base
111'9"
MI 1·5 VMI 16·1 FC 59·5 A 22·9 BTU/lb 11,320 SI 0·36 SG 1·489 Coking tests Class Af Swl 2 94·8%
87'10½" – 88'5" A 89·7 SG 2·513
MI 2·6 VMI 10·9 FC 28·6 A 57·9 BTU/lb 5480 SI 0·20 SG 1·887 Coking tests Class Aw Swl 1 65·7%
MI 2·0 VMI 14·0 FC 46·5 A 37·5 BTU/lb 8910 SI 0·32 SG 1·627 Coking tests Class Af Swl 1 69·1%
A 53·1 SG 1·829 58·6%
MI 1·4 VMI 16·7 FC 58·0 A 25·9 BTU/lb 10430 SI 0·32 SG 1·539 Coking tests Class Af Swl 1 81·7%
A 65·6 SG 2·021 71·4%
N.S. 21
144'7"
4" inf coal; 1½" carb. sh;
10½"(p.b) dk gy sh,
146'3½"
1'3½" coal;
147'7"
2'10" coal & inf. coal;
150'6"
1'7½" inf. coal – coal;
1½" dk gy sh,
6½" coal;
152'11½"
1" dk gy sh; 1" coal; ½" dk gy sh,
153'6"
3" inf. coal, 1" dk gy sh;
2'2"(p.b) inf. coal – coal – shaly for 3" at 9½" fr top;
155'10½"
7½" dk gy sh w few coal lents
156'6"
MI 1·5 VMI 15·2 FC 59·3 A 24·0 BTU/lb 11190 SI 0·31 SG 1·498 Coking tests Class Af Swl 2½ 96·3%
MI 2·0 VMI 13·8 FC 49·0 A 35·2 BTU/lb 9230 SI 0·38 SG 1·594 Coking tests Class Af/Cw Swl 3½ 92·4%
A 66·6 SG 2·013 100%
N.S. 22
123'4"
1'10½" carb. sh. w l. gy sh. lam in btm 4";
1" l gy – br. sh;
4" carb sh w num coal lents → inf in btm 1½";
127'5"
7'2" coal, slightly inf in top 3½";
¼" l gy sh 4'1" fr. top;
130'6"
1½" dk gy sh.;
5" coal; 1" carb. sh; 1" br. sh;
9½" coal,
132'0"
133'1"
7'8" coal w few carb. sh. lents, ¼" l gy sh at 1'1" fr top, ½" nod iron. carb 3'2" fr. top;
136'5"
139'9"
5" dk gy sh,
7" gy sh
140'9"
MI 1·5 VMI 11·9 FC 59·8 A 26·8 BTU/lb 10040 SI 0·24 SG 1·573 Coking tests Class Af Swl 1 100%
MI 1·6 VMI 23·4 FC 60·3 A 14·7 BTU/lb 12260 SI 0·24 SG 1·437 Coking tests Class Af Swl 1 100%
MI 1·5 VMI 22·5 FC 51·7 A 23·9 BTU/lb 10560 SI 0·23 SG 1·526 Coking tests Class Af Swl 1½ 100%
MI 1·7 VMI 21·8 FC 61·6 A 15·0 BTU/lb 12290 SI 0·38 SG 1·421 Coking tests Class Af Swl 2 97·5%
MI 1·8 VMI 24·7 FC 64·1 A 9·4 BTU/lb 13.470 SI 0·23 SG 1·342 Coking tests Class Cm Swl 5½ 100%

FIG. 5 D

NEBO — DIAGRAMS OF ELPHINSTONE SEAM

DETAILS OF CORE RECOVERY AND ANALYSES

N.S. 28

Results of Analysis	Recovery per cent	Section Sampled	Description
		118′	2′0½″ l gy-wh f. sa.,
			5½″ gy sh,
		120′7″	1″ inf. coal; 2″ gy sh w coal lents;
			8″(b) coal w small amt dk gy sh,
M 2·1 VM 18·9 FC 49·0 A 30·0 Coking tests Class Af Sw I 1	74·4%		
		121′11″	1″ inf. coal;
			8¼″ coal w ½″ lens dk gy. sh 2″ fr base; 6″ dk gy sh;
		123′2¼″	
M 1·8 VM 21·0 FC 59·2 A 18·0 Coking tests Class Af Sw I 1½	97·1%		1′3″ coal,
			¾″ carb sh; 2¾″ coal, ¼″ dk gy sh,
		124′11″	2″ coal; 4″ coal,
			2″(b) slightly inf coal;
Composite M 1·9 VM 20·8 FC 58·0 A 19·3 BTU/lb 11900 S 0·79 SG 1·445 Coking tests Class Af Sw I 1			3″ slightly inf. coal, ½″ lent gy sh;
M 1·6 VM 20·6 FC 57·1 A 20·7 Coking tests Class Af/Cw Sw I 1·2	89·6%		6″ coal; 2″ inf. coal,
			8″ coal,
		127′11″	7″ slightly inf. coal;
			11″(b) coal slightly inf for 2″ in mid
M 1·9 VM 20·3 FC 63·1 A 14·7 Coking tests Class Af/Cw Sw I 2	97·9%		8″ coal,
			½″ coaly sh,
			6″(b) coal,
		130′7″	6¾″ coal,
			1′6½″ coal,
M 1·9 VM 21·5 FC 63·4 A 13·2 Coking tests Class Af Sw I 1	99·0%		1″ inf. coal,
			1′9″ coal,
		134′7″	1″(b) slightly inf coal,
			5″ coaly sh.;
			1′11″(b) gy sh.
		137′0″	

N.S. 29

Results of Analysis	Recovery per cent	Section Sampled	Description
		78′6″	7′11″ sh w coaly lam near base,
		86′3″	
		86′6″	2′1″ sl. inf. coal — coal;
M 1·0 VM 20·2 FC 49·5 A 29·3 Coking tests Class Af Sw I 1	100%		1′2″ inf. coal with 2″ coal at 2″ fr. base;
		89′6″	10″ coal,
M 1·2 VM 18·9 FC 67·0 A 12·9 Coking Tests Class Af Sw I 1	68·8%		1″ coaly sh.,
			5½″(b) coal,
			4½″ coal w thin sh beds,
		92′6″	7″ coal,
			2½″ inf. coal, 3″ v inf coal — coaly sh,
M 1·2 VM 19·2 FC 60·9 A 18·7 Coking tests Class Af Sw I 1½	100%		1′11½″ coal,
		95′6″	
M 1·3 VM 19·2 FC 63·5 A 16·0 Coking tests Class Af Sw I 1½	100%		3′2″ coal — slightly inf. in btm 2½″,
Composite M 1·1 VM 19·3 FC 60·1 A 19·5 BTU/lb 11890 S 0·85 SG 1·409 Coking tests Class Af Sw I 1		98′6″	3″ slightly inf coal;
			10½″ coal;
M 1·1 VM 21·0 FC 65·1 A 22·8 Coking tests Class Af Sw I 1	100%		1″ carb sh.;
			1′1″ coal,
			5½″ dk gy sh;
		101′6″	3″ coal, 1¼″ gy sh; ½″ coal,
M 1·1 VM 18·4 FC 66·9 A 13·6 Coking tests Class Af Sw I 1	83·3%		2′6″(b b) coal,
		104′6″	
M 1·2 VM 18·0 FC 63·9 A 16·9 Coking tests Class Af Sw I 1	100%		3′0″ coal,
		107′6″	
M 1·2 VM 18·4 FC 60·2 A 20·2 Coking tests Class Af Sw I 1½	97·8%		2′11″ coal - sl. inf. in places;
		110′6″	9″(b) coal & sh;
		111′3″	1′5″ dk gy. sh.,
			9″(b) dk gy. sh;
			1′5″ gy sh,
			4″(b) gy sh,
			9″ gy sh;
			11″(b) gy sh
		118′½″	

QUEENSLAND

DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

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MESOZOIC AND CAINOZOIC SEDIMENTS OF THE WROTHAM PARK AREA

By J. T. WOODS, M.Sc.,
Supervising Geologist (Palaeontology)

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MESOZOIC AND CAINOZOIC SEDIMENTS OF THE WROTHAM PARK AREA

By J. T. WOODS, M.Sc., Supervising Geologist (Palaeontology)

Abstract

The Mesozoic sediments in this area at the eastern margin of the Carpentaria sub-basin comprise three formations of Lower Cretaceous age. The oldest unit, the Wrotham Park Sandstone, of probable Neocomian age, is about 200 ft. in thickness and contains at least one marine horizon in its lower part. Conformably succeeding it is the Blackdown Formation of Aptian age, which is of similar thickness, but consists mainly of shales and siltstones. Preliminary determinations of its rich marine fauna are tabulated. The ammonite assemblages show that the previously accepted division of the Aptian sequence of the Great Artesian Basin into stages is not valid. The third unit, the previously unnamed "Trimble Formation," recognised on the basis of its marine fauna of Albian age, has a very limited outcrop area.

Another new stratigraphic name, the "Louisa Formation," is proposed for unfossiliferous sands and gravels, presumably of Lower Cainozoic age, which occur in scattered elevated residuals. Upper Cainozoic fluviatile sediments, which are also unfossiliferous and are widespread in areas of low relief, comprise the ?Pliocene Lynd Formation, which displays mild lateritic effects, and younger unconsolidated sands and gravels.

A geological reconnaissance of an area, centred on Wrotham Park station homestead (lat. 16° 39′ S., long. 144° O′ E.) in north Queensland, was made from 20th June to 6th July, 1960. The area extends from the Mt. Mulgrave road crossing of a branch of Blackfellow Creek in the north to Boomer's Waterhole in the Walsh River in the south, and from Trimble's Crossing of the Walsh River in the north-west to the crossing of Nolan Creek by the Wrotham Park-Mungana road in the south-east.

The work was carried out from the Mitchell River base camp of the combined Bureau of Mineral Resources and Geological Survey of Queensland field party engaged on the geology of the Mossman Four Mile Map. I am indebted to the leader, Dr. F. de Keyser, who placed every facility of the party at my disposal. Most of my field work was carried out with the assistance of Mr. R. M. Tucker, Geologist of the Geological Survey of Queensland. An examination of some of the Cainozoic deposits was made in the company of Mr. L. C. Noakes, Assistant Chief Geologist of the Bureau of Mineral Resources.

The purpose of the work was to collect ammonites and other marine Cretaceous fossils and to examine the distribution and stratigraphic relationship of the Cretaceous sediments. A notable proportion of the type and figured ammonites of Aptian age, described by Whitehouse (1926, 1927), have as their locality "Walsh River." However, the number of specimens referred to many of the species is small, and it was considered desirable to obtain large collections from precisely known localities to assist the projected taxonomic revision of those forms, and to determine their usefulness as index fossils for stratigraphic subdivisions of the marine Cretaceous sediments of the Great Artesian Basin.

Previous Work

Norman Taylor, a member of Hann's Northern Exploring Expedition of 1872, was the first geologist to visit the area and some geological notes were included in both the official report and diary of the expedition (Hann, 1873 a, b). Subsequently some additional notes, provided by Taylor, were published by Jack and Etheridge (1892). In the present century, geological investigations of the Mesozoic sediments of the area have related chiefly to the search for oil, and unpublished reports have been provided by Morton (1930, with relevant palaeontological report by Whitehouse (1929), Laing *et al.* (1956), and Dixon (1957). Recently Laing and Power (1959) have formally proposed names for two formations of Cretaceous age and one of Tertiary age, which have their type localities in the area.

Basement Rocks

Representatives of the Precambrian Dargalong Metamorphics, the middle Palaeozoic Chillagoe Group, and Permian volcanics and associated sediments form the basement for the Mesozoic and Cainozoic sediments. No detailed examination of these basement rocks was made and they are not differentiated on the map.

Mesozoic Sediments

Wrotham Park Sandstone (Laing and Power, 1959)

The oldest Mesozoic sediments are dominantly sandstones. They have a low regional dip to the west or south-west. In the eastern part of the area they are exposed in a low dissected plateau with a steep eastern scarp, and may be seen to unconformably overlie the Palaeozoic basement. Numerous outliers exist in the form of cappings of mesas, particularly in the south-east. Dixon (1957) traversed and mapped the continuous basal contact of the Mesozoics between the Tate and Mitchell Rivers. The impression is gained, both from reconnaissance and examination of aerial photographs, that there was considerable irregularity in the pre-Cretaceous surface, with the Permian volcanics, in particular, standing as basement highs

in the North and South of the area. Dixon (1957) stated that irregularities in the pre-Cretaceous surface were as much as 600 feet in the region he mapped.

Nolan, Elizabeth, and Greenmantle Creeks, flowing as consequent streams, have cut steep gorges through the sandstones. There appears to have been capture of the head of Greenmantle Creek by one of the south-western tributaries of the Dry River, and the road from Bellevue to Wrotham Park passes through the gap.

In the gorge at the head of Greenmantle Creek the sequence begins with pebble conglomerates and light breccias, passing upward to grits and felspathic sandstones. Some current bedding and lenticularity of beds are apparent. While some sandstones are flaggy, the jointing in more massive beds gives rise to steep cliffs. Rare impressions of indeterminable plant stems are present in the sandstones. The thickness of the formation in this gorge is approximately 200 feet. Laing and Power (1959) have described the colour of the sandstones as red. Red and brown are the predominant colours of the upper horizons of topographically elevated occurrences, where ferruginization with broad mottling and local patchy silicification may be interpreted as lateritic effects. Elsewhere the sandstones display light colours.

To the west the sandstones dip beneath the conformable Blackdown Formation. The boundary occurs in low rolling country with outcrops usually only in watercourses, but the sandy soil developed on the sandstone aids their delimitation in the field. Photo-interpretation is complicated, however, by the occurrence of widespread sandy alluvia of upper Cainozoic age, sometimes with a vegetation pattern very similar to the sandstones.

In several places a fine glauconitic "sandstone" of very uneven texture occurs at the top of the formation. In the hand specimen it shows small sandy claystone patches almost devoid of glauconite, while the distribution of glauconite through the remainder of the rock is uneven. The rock does not have the appearance of an intraformational conglomerate and its mode of origin is problematic. It was encountered at the Mt. Mulgrave road crossing of a branch of Blackfellow Creek, in Elizabeth Creek, in a ?faulted inlier in the bed of the Walsh River 1 mile north of Boomer's Hole, and in the type area on the Mungana road 8 miles south-east of Wrotham Park. It was not seen in Greenmantle Creek.

Weathered olive grey sandstone occurs in the banks of Boomer's Hole. It was established that the thickness of the sandstone decreases to the north, and it underlies shale of the Blackdown Formation. The southern end of Boomer's Hole was not examined.

Fossils are rare in the Wrotham Park Sandstone. Mr. W. R. Morgan, of the Bureau of Mineral Resources, found marine fossils in sandstone at the top of a a small outlying mesa, 3 miles south-east of the crossing of Nolan Creek by the Wrotham Park-Mungana road. Subsequently *Maccoyella barklyi* (Moore) was found to be abundant in a thin band. Several specimens of a large undescribed terebratuloid brachiopod were also collected (W40). Less than 50 feet of sandstone are exposed on this residual. A slab of red sandstone with numerous similarly preserved specimens of *M. barklyi,* collected by Mr. L. C. Ball in 1922, is present in the G.S.Q. collections from "2M. below Wrotham Park road Crossing Nolan Creek."

Laing and Power (1960) suggest correlation of the Wrotham Park Sandstone with the Gilbert River Formation (thickness 110 ft.). The general lithology is similar, but the palaeontological evidence is inconclusive, with *M. barklyi* the only species in common. Possibly equivalent sediments have been penetrated in bores in the Carpentaria Sub-basin. Power and Lindhe (1957) recognise " . . . glauconitic . . . silty sandstone" from 1,998 ft. to 2,344 ft., and "Coarse . . . felspathic sandstone . . . " from 2,344 ft. to 2,906 ft. in Z.C.L. No. 1, Weipa; Wood (1958) recognises "Blythesdale sandstone" from 2,623 ft. to 2,763 ft. in F.B.H. No. 1, Wyaaba; and Laing (1958) recognises Wrotham Park Sandstone, from 2,277 ft. to 2,360 ft. in A.A.O. No. 8, Karumba.

On consideration of the limited thickness of this arenaceous sequence, and its position below conformable sediments of Aptian age, a basal Cretaceous (Neocomian) age is suggested for the Wrotham Park Sandstone.

Blackdown Formation (Laing and Power, 1959)

This formation conformable succeeds the Wrotham Park Sandstone. It consists mostly of grey shales, siltstones, and sandy shales, which become olive and buff-yellow on weathering. Some grey, olive, and buff lenticular sandstones are present. The sediments have eroded to give a gently undulating "rolling downs" topography and have developed on them grey and brown clay soils. The country is grassland, lightly timbered with mimosa and bauhinia. Apart from the soil cover, a veneer of upper Cainozoic alluvia obscures much of the formation, and outcrops are scattered.

Sandstones, some of them carrying glauconite, make up a minor part of the sequence. Observations made along Elizabeth Creek, where the best exposures are, suggest that the sandstones are lenticular and are scattered through much of the formation.

Calcareous concretions, including rare septaria, occur in both shales and sandstones and tend to be concentrated on certain bedding planes. Most are ellipsoidal, with the longer axes parallel to the bedding. Near the base of the sequence some of the structures are of large size, ranging up to 8 ft. in diameter. There is evidence that some of the concretions are syngenetic. Some of those, particularly from sandy beds, from several localities towards the base of the formation, are texturally very similar to the glauconitic "sandstone" from the top of the Wrotham Park Sandstone, and differ conspicuously from their matrix. Such concretions are often of irregular form. In some instances fossils are not preserved beyond the boundaries of the concretions, suggesting weathering or incomplete preservation before the structure was covered with sediment. A petrological report by Miss B. R. Houston on some of the concretionary material is appended. While most fossils, particularly ammonites, are found in

concretions, the proportion of concretions containing macrofossils is small. At some horizons rich in pelecypods, near the base of the sequence north of Boomer's Hole and in Elizabeth Creek, concretionary material is restricted to the infilling of the shell, or may show limited development as at one end of the shell. While the preservation of the shells indicates that this condition is not due to weathering, it is not clear whether such concretions are syngenetic or epigenetic.

Small normal faults are common in the shales and siltstones, especially near the small inlier of glauconitic "sandstone" 1 mile north of Boomer's Hole. The largest throw observed was 10 feet. Immediately to the south of this inlier, the induration of the sediments along the major joint planes, which are vertical and strike N.40°—60°E., is a conspicuous feature, as the structures stand in relief as dyke-like bodies in the river bed and adjacent cliffs. The general north-north-westerly course of the Walsh River in the map area represents a considerable change from the course upstream. While it appears to roughly delimit the outcrop area or near subsurface occurrence of the Cretaceous sediments, no structural control of the stream direction is apparent.

Fossils are sporadically distributed in the formation but some localities are rich and a large collection was made. The occurrence of the forms has been tabulated and the localities marked on the map. While it is realised that many of the forms require taxonomic revision, published names have been generally adhered to in the table.

The assemblages do not support the division by Whitehouse (1928) of the "Roma Series" into four faunal stages, viz. Ancyloceratan Stage, Australiceratan Stage, Tropaeuman Stage, and Ammonitoceratan Stage. The occurrence of abundant *Australiceras irregulare, Aconeceras walshense, Sanmartinoceras olene,* and *Peratobelus selheimi* (with which the *Peratobelus* sp. nov. of Whitehouse is here indentified) in close association in Elizabeth Creek at locality W.14 comprises forms representative of his upper three stages. Furthermore the occurrence of specimens closely resembling published figures of *Tropaeum australe* and *T. undatum,* with *Australiceras jacki* and *Toxoceratoides taylori,* near Boomer's Hole at locality W.8, constitutes an association of the two middle stages. Consequently neither the arrangement of the Aptian fossils from the Walsh River district postulated in Whitehouse's report (1929), nor the suggested distribution of the faunal stages shown on his accompanying map, is supported.

No definite subdivisions of the Blackdown Formation can be proposed at present. The available evidence suggests that the lower part of the section is characterized by the pelecypods *Mytilus palmerensis, Panope rugosa, Gari elliptica,* and *Macrocallista plana,* which persist to a prominent ammonite horizon with *Australiceras jacki* (and closely related forms) and *Toxoceratoides taylori.* If the low regional dip of the scattered outcrops is the only factor, a stratigraphically higher fauna is characterized by *Australiceras irregulare, Toxoceratoides* (?) sp. nov., *Sanmartinoceras olene, Aconeceras walshense,* and large individuals of *Peratobelus selheimi.* North of the crossing of the telegraph line of Louisa Creek, locality W.23, with elements of the latter fauna, is believed to be stratigraphically above locality W.26, on account of its greater topographic elevation. It is quite feasible, especially in view of the sporadic occurrence of the fossils, that local ecological factors were important in their distribution and the stratigraphic value of these faunas is limited. While an environmental control is not obvious from the sediments, the occurrence of a single individual of *Sanmartinoceras* cf. *olene* at W.35, low in the section in Elizabeth Creek, urges a cautious view.

The presence of glauconite, often in large concretions of syngenetic origin, suggests slow sedimentation under anaerobic conditions. The presence of pyrite similarly indicates local anaerobic conditions. Many of the pelecypods show both valves in apposition and this suggests quiet conditions at those horizons.

The greatest thickness of the Blackdown Formation exposed in any continuous section is 70 ft. in the cliffs and ridges adjacent to the Walsh River, north of Boomer's Hole, in the vicinity of locality W.8, in beds believed to be near the base of the formation. Laing *et al.* (1956) indicate that water-bearing sandstone (probably of the Wrotham Park Sandstone) is penetrated in bores at depths of about 100 ft. Allowing for the low regional dip, a maximum thickness of about 200 ft. for the formation in the map area is likely.

The ammonites indicate that the Blackdown Formation is Aptian in age, and a correlation with part, at least, of the Roma Formation, is apparent. A detailed comparison of the fauna with that of the lower part of the Roma Formation and the "transition beds" of the Blythesdale Group in the Roma area should be of particular interest. In the Carpentaria Sub-basin the fauna described by Tenison–Woods (1883) from "drifted nodules" from the bed of the Palmer River is identical with elements of the Blackdown Formation. Other ammonites indicate equivalent sediments in the valleys of the Tate and Lynd Rivers. While subdivisions of the marine Cretaceous rocks in the Weipa, Wyaaba, and Karumba oil bores are, by necessity, somewhat tentative, they indicate a marked thickening of the Aptian sediments westwards, with a maximum of over 1,800 ft. (810 ft. to 2,623 ft.) for the "Roma Series" in F.B.H. No. 1, Wyaaba (Wood, 1958). Minor interbeds of glauconitic sandstone were reported from all three bores.

"Trimble Formation"

This name is proposed for Cretaceous sediments in the north-west of the map area which are faunally distinct from the Blackdown Formation and are typically developed at the following locality.

At Trimble's Crossing, where a causeway for the new Wrotham Park-Dunbar road crosses the Walsh River, about 20 ft. of nearly horizontal, fine, grey, ?calcareous sandstone outcrops. Apart from unfossiliferous subspherical sandstone concretions, which have the appearance of being epigenetic, occasional large "concretions" of sandy glauconitic calcilutite are present (see appended petrological report), with

numerous remains of *Aucellina hughendenensis* (Etheridge) and *Inoceramus etheridgei* Etheridge fil. (W.49). *Inoceramus* shell fragments and prisms are abundant in the rock.

An Albian age is indicated by the presence of these species. Whitehouse had earlier (1929) determined a fauna of similar age collected by Mr. C. C. Morton from shales exposed in a sweeping bend of the Walsh River about 1·5 miles downstream from its junction with Louisa Creek.

Both occurrences appear as inliers surrounded by upper Cainozoic alluvia in the valley of the Walsh River. Apart from their position "down dip," nothing of their structural relationship to established occurrences of the Blackdown Formation can be stated.

Sediments of Albian age, referred to the Normanton Formation by Laing and Power (1959), outcrops in the Carpentaria Sub-basin in the vicinity of Normanton. In the report on A.A.O. No. 8, Karumba, Laing recognised Albian sediments between 129 ft. and 1,300 ft.

Cainozoic Sediments

"Louisa Formation"

Because of general lithological similarity and topographic relationship, the sediments of isolated residuals in the north-western part of the area are associated in this previously unrecorded formation. It is typically developed at the following locality.

East of the Mt. Mulgrave road, 4·0 miles north of Wrotham Park homestead, a residual rises 180 ft. above the surrounding low country of the Blackdown Formation. The hill is covered with a heavy mantle of "billy," some of it with rough columnar structure. Well rounded quartz gravels in a sandy matrix underlie the "billy" and the distribution of the "billy" is believed to be due to the progressive erosion of the sediments and the collapse of a capping.

About 11 miles north-west of the homestead, low hills, locally known as the "Back-o-the-Moon Range," are crossed by the new Dunbar road. Similar quartz gravels with a brownish sandy matrix occur, but no "billy" boulders were seen in a rapid examination. The only evidence to be interpreted as possibly indicative of past lateritic processes is the presence of boulders of ferruginous grit. The low hills rise to about 100 ft. above the surrounding country of the Blackdown Formation.

To the east, along the Dunbar road where the Mt. Mulgrave road crosses the low divide between Louisa Creek and Blackfellow Creek, patches of sandy soil with quartz pebbles may be taken as evidence of the previous greater extent of the formation. Similarly, the abundance of "billy" boulders capping unusually elevated shales of the Blackdown Formation between the homestead and the crossing of Elizabeth Creek to the west may be explained in this way.

Laing *et al.* (1956) mapped some of these occurrences as outliers of the "Walsh Formation" (=Lynd Formation of Laing and Power (1959)). However the sediments of the latter formation are topographically lower and lithologically different.

If the local ferruginization and silicification are correctly interpreted as results of lateritic processes, it is possible that these residuals, together with the dissected plateau of Mesozoic sandstones to the east, form the remnants of a surface which was reduced to base level and lateritized in middle Tertiary time, then elevated and greatly dissected. A middle or lower Tertiary age for the "Louisa Formation" is suggested.

Further to the north, beyond the map area, the Mt. Mulgrave road crosses a residual with sediments similar to those nearer Wrotham Park. Where the road leaves the scarp above the old flood plain of the Mitchell River, 3·2 miles south of the crossing, red earths are developed on quartz gravels and associated ferruginous sandstone grit. One mile to the south, in a scarp of the same residual, ferruginous grit was prominent in outcrop, but crumbled easily when the "case-hardened" surface was broken. Again no lateritic profile was seen. Lithologically these sediments resemble those of the "Louisa Formation" rather than the Wrotham Park Sandstone.

Along the same road, about 8 miles south of the Mitchell River, gritty sandstones, which are mottled and locally silicified, occur in depressions in Permian volcanics. No evidence for the age of these sediments was found.

Lynd Formation (Laing and Power, 1959)

This formation of loosely compacted fluviatile sediments, which are widely distributed in the valleys of the Walsh River and its major tributaries, forms the oldest, that is, topographically highest terrace, observed to extend to up to 50 ft. above the present streams' beds. It comprises polymict gravels (with abundant pebbles and cobbles of volcanic rock and occasional pebbles of "billy"), sands, and sandy clays. Evidence of lateritic processes is variable. Broad mottling, with some of the ferruginous patches so cemented as to be able to withstand weathering, is commonly seen in the coarser clastics. A more extreme effect occurs in the type area along the Blackdown track 7 miles south of Walsh Telegraph Station, where, locally, a ferruginous nodular zone overlies a more consolidated (? partially silicified) horizon. In contrast, the sandy clays, such as those exposed in gullies near Wrotham Park homestead, have developed on them podsolic soils. Under relatively heavy traffic, the upper horizon readily powders when dry, and thick dust accumulates on the roads and tracks near the homestead.

No fossils were found in these sediments, but a fossil crocodilian vertebra, in the collections of the Queensland Museum, from "Wrotham Park Station" is presumably from the formation. However it does not help to fix the age. A general correlation with the Glendower Formation has been made by Laing and Power (1959) and an upper Cainozoic (?Pliocene) age appears reasonable. The Lynd Formation does not appear to exceed 50 ft. in thickness in the Wrotham Park area, but bore logs indicate marked thickening of the Cainozoic sediments westward in the sub-basin. It is possible that some of this thickness should be attributed to older Tertiary sediments.

In the map area there are widespread superficial fluviatile deposits, which appear to be younger than the Lynd Formation. The sediments, comprising both gravel and sands, are quite unconsolidated. While they can be distinguished in the field, it is difficult to differentiate between the older and younger alluvia on the aerial photographs. Consequently the undifferentiated upper Cainozoic alluvia are shown as a unit on the accompanying map and recognised occurrences of the Lynd Formation are indicated by the appropriate symbol.

REFERENCES

DIXON, L. H., 1957. Geological Traverse along Basal Mesozoic Contact in Cairns Hinterland. Frome-Broken Hill Co. Pty. Ltd. Rep. 5300G 12 (Unpub.) Geol. Surv. Qd. Lib.

HANN, W. 1873a. Report from Mr. W. Hann, Leader of the Northern Expedition Party. *Votes, Proc. Legisl. Assem., Qd.*, 1873, pp. 1031-1043.

————, 1873b. Copy of the Diary of the Northern Expedition under the Leadership of Mr. William Hann. *Votes, Proc. Legisl. Assem., Qd.*, 1873, pp. 1045-1070.

JACK, R. L. AND ETHERIDGE, R. 1892. The Geology and Palaeontology of Queensland and New Guinea. *Publ. Geo. Surv. Qd.*, 92, 2 vols.

LAING, A. C. M., 1958. Final Report on A.A.O. No. 8 (Karumba). Mines Administration Pty. Ltd., Rep. Q/45P/44. (Unpub.). Geol. Surv. Qd. Lib.

————, AND POWER, P. E., 1959. New Names in Queensland Stratigraphy. *Aust. Oil Gas J.*, 5 (8), pp. 35-36; (9), p. 28.

————, AND POWER, P. E., 1960. Carpentaria Sub-basin, in Geology of Queensland. *J. Geol. Soc. Aust.*, 7, pp. 324-328.

————, POWER, P. E., AND STARKEY, L. J., 1956. Geology and Geophysics of Carpentaria. Authority to Prospect 9P, Qd. Mines Administration Pty. Ltd. Rep. Q/C/28 (Unpub.). Geol. Surv. Qd. Lib.

MORTON, C. C., 1930. Re search for Oil—Wrotham Park. (Unpub.) Rep. Geol. Surv. Qd. Lib.

POWER, P. E. AND LINDHE, W. N., 1957. Z.C.L. No. 1 (Weipa) Well Completion Report (Unpub.). Geol. Surv. Qd. Lib.

WOOD, R. L., 1958. F.B.H. No. 1 (Wyaaba) Well, Queensland. Frome-Broken Hill Co. Pty. Ltd. Report 5300 W1 (Unpub.). Geol. Surv. Qd. Lib.

TENISON-WOODS, J. E., 1883. On some Mesozoic fossils from the Palmer River, Queensland. *J. Roy. Soc.* N.S.W., XVI, pp. 147-154, pls. 7-8 & 10.

WHITEHOUSE, F. W., 1926. The Cretaceous Ammonoidea of Eastern Australia. *Mem. Qd. Mus.*, 8, pp. 195-242, pls. 34-41.

————, 1927. Additions to the Cretaceous Ammonite Fauna of Eastern Australia. Part I. *Mem. Qd. Mus.*, 9, pp. 109-120, pls. 16-17.

————, 1928. The Correlation of the Marine Cretaceous Deposits of Australia. *Rept. Aust. Assoc. Adv. Sci.*, XVIII, *Sect.* C, pp. 275-280.

————, 1929. Report on a Collection of Marine Cretaceous Fossils collected by Mr. C. C. Morton from the Walsh River District, North Queensland. (Unpub.) Rep. Geol. Surv. Qd. Lib.

PETROLOGICAL REPORT ON ROCKS FROM WROTHAM PARK

(Collected J. T. Woods)

Specimen GSQ/R. 1035 : *Bellevue Track. N.E. of Wrotham Pk. Homestead*:

A yellowish-coloured massive sediment comprising irregular sandy patches and finer material with fairly widely, irregularly dispersed sand grains.

Microslide GSQ 908:

In the thin section the sandy fraction has an average grain size of 1·5-2 mm. and the sand grains make up about 50 per cent. of that part of the rock. These grains are subangular to subrounded and include quartz, quartzite, feldspar (including fresh plagioclase), fine-grained rock fragments, calcite and "glauconite". No mineral is outstandingly more abundant than the others.

The matrix is a very fine-grained combination of argillaceous material and calcite, all irregularly stained with limonite.

The fine fraction of the rock resembles the matrix of the sandy fraction and has a minor quantity of sand grains enclosed within it (probably 5%).

Name.—Calcilutite-pebble CONGLOMERATE.

Note.—This rock has the appearance of a conglomerate. The gradation of sand grains across the "calcilutite-pebble" boundaries is a puzzling feature. The most likely explanation is that the sand grains have been pressed into the plastic lime mud.

Specimen GSQ/R. 1036 : *Walsh River, near Boomer's Hole*:

A brownish-grey, massive fine-grained sediment.

Microslide GSQ 909:

A very fine-grained rock composed essentially of calcite and argillaceous material, slightly limonite-stained, with irregularly-shaped silt-size fragments similar to those in GSQ 908. The fragments occupy 25% of the rock.

The rock is traversed by fine calcite veins.

Name.—CALCILUTITE.

Specimen GSQ/R 1037 : *Trimble Crossing, Walsh River*:

A light-grey, fine-grained sediment with abundant shelly fragments.

Microslide GSQ 910:

In thin section comprising 35-40%, sand-sized, subangular to subrounded calcite fragments and 5% "glauconite" pellets, in a matrix composed of calcite and argillaceous material.

Prisms of calcite (*Inoceramus*) and calcareous *Aucellina* fragments are relatively abundant. (J. T. Woods.)

The rock is traversed by fine calcite veins.

Name.—Calcareous-sandy CALCILUTITE.

Note.—The general usage of the term "glauconite" is for small greenish pellets of heterogeneous mineral content. Essentially "pure" glauconites can only be distinguished from the chlorites by X-ray photography.

B. R. HOUSTON, Geologist.

3rd October, 1960.

OCCURRENCE OF FOSSILS IN THE BLACKDOWN FORMATION IN THE WROTHAM PARK AREA

(See accompanying map) (Localities roughly in stratigraphic order)

r = rare (1–2) c = common (3–10) a = abundant (11 +) o = observed, but not collected

——	W47	W10	W35	W34	W3	W8	W7	W36	W32	W50	W19	W26	W29	W14	W4	W23
Panope rugosa Moore	r	a	c			r				r						
Mytilus palmerensis Etheridge fil.	c	a	r	r	r	r										
Gari elliptica Whitehouse	r	a	r	r	r	r				c						
Fissilunula clarkei (Moore)	r	r	r		r	c										
Maccoyella barkyli (Moore)	c	r	c		r			o		r						
Macrocallista plana (Moore)		c	r			r				r						
Nucula sp.		c				r				r						
" *Cucullaea* " *robusta* Etheridge		r	r			r								r		
Syncyclonema socialis (Moore)		r														
Thracia cf. *wilsoni* (Moore)		r	r			r										
Australiceras aff. *jacki* (Etheridge fil.) (including *A. transiente* Whitehouse)		r				c		r	r	c	r					
" *Tropaeum* " *leptum* (Etheridge fil.)		r														
" *Tropaeum* " sp.		r														
Peratobelus spp.		r	r			r							r			
Algal Structures		r	o			r										
Teredo sp.		o					r									
Enoploclytia tenuidigitata Woods		c							r					r	r	
Sanmartinoceras cf. *olene* (Tenison-Woods)			r													
" *Mytilus* " sp.—thick shelled			r		c											
" *Mactra* " trigonalis Moore			a													
" *Malletia* " sp.				r	r	r				a	a	r				
Pseudavicula australis (Moore)				r	o											
Pinna sp. (= *Pinna* sp. ind. Etheridge fil. 1892)					c	o		r								
" *Trigonia* " cf. *nasuta* Etheridge					r											
Australiceras sp.					r											
Toxoceratoides taylori (Etheridge fil.)					r	a				r	r					
Tatella sp.					c	r										r
? *Viviparus* sp.					r											
Enoploclytia terra-reginae Etheridge fil.						r										
? *Pleuromya* sp.						r				r						
" *Tropaeum* " *australe* (Moore)						r		r								
" *Tropaeum* " *undatum* Whitehouse						r										
" *Australiceras* " spp.—juveniles						c										
Acteon hochstetteri (Moore)						r				r						
Dentalium sp.						r				a	a	a				
? *Cinulia* sp.								r								
Turritella walshensis Etheridge fil.										r						
Astarte wollumbillaensis Moore												a				
Australiceras irregulare (Tenison-Woods)														a		
Sanmartinoceras olene (Tenison-Woods)														a	r	r
Aconeceras walshense (Tenison-Woods)														a		
Toxoceratoides (?) sp. nov.														c		
Solemya cretacea Etheridge fil.														r		
Peratobelus selheimi (Tenison-Woods)														c		r
? *Peratobelus selheimi* (Tenison-Woods)—guards only														a		
Mecochirus sp. nov.														r		
Callianassa sp.														r		

S. G. REID, Government Printer, Brisbane

GEOLOGICAL SKETCH MAP OF THE WROTHAM PARK AREA

To accompany Report by J.T. Woods M.Sc.

Scale of Miles

1 0 1 2 3

Roads and Tracks. ---------

Fossil Localities ◎

All Boundaries approximate; by photo-interpretation. -·-·-·-

Eastern boundary of Wrotham Park Sandstone modified from Dixon (1957)

CAINOZOIC

- Upper Cainozoic — Czu/Tly — Undifferentiated upper Cainozoic fluviatile sediments (Czu) and ? Pliocene Lynd Formation (Tly)
- ? Lower Tertiary — Tlo — "Louisa Formation"

CRETACEOUS

- Albian — Kltr — "Trimble Formation"
- Aptian — Klbk — Blackdown Formation
- Neocomian — Klwr — Wrotham Park Sandstone

PALAEOZOIC AND PRECAMBRIAN — B — Undifferentiated Basement Rocks

Bellevue

Cassidy

Bowler

Trimble Crossing

To Duaringa

BACK-O'-THE-MOON RANGE

To Mt Mulgrave

Blackfellow

Yard Mill

Louisa

Power

Elizabeth

Greenmantle

Wrotham Park

Walsh Telegraph Station

Air Strip

WALSH RIVER

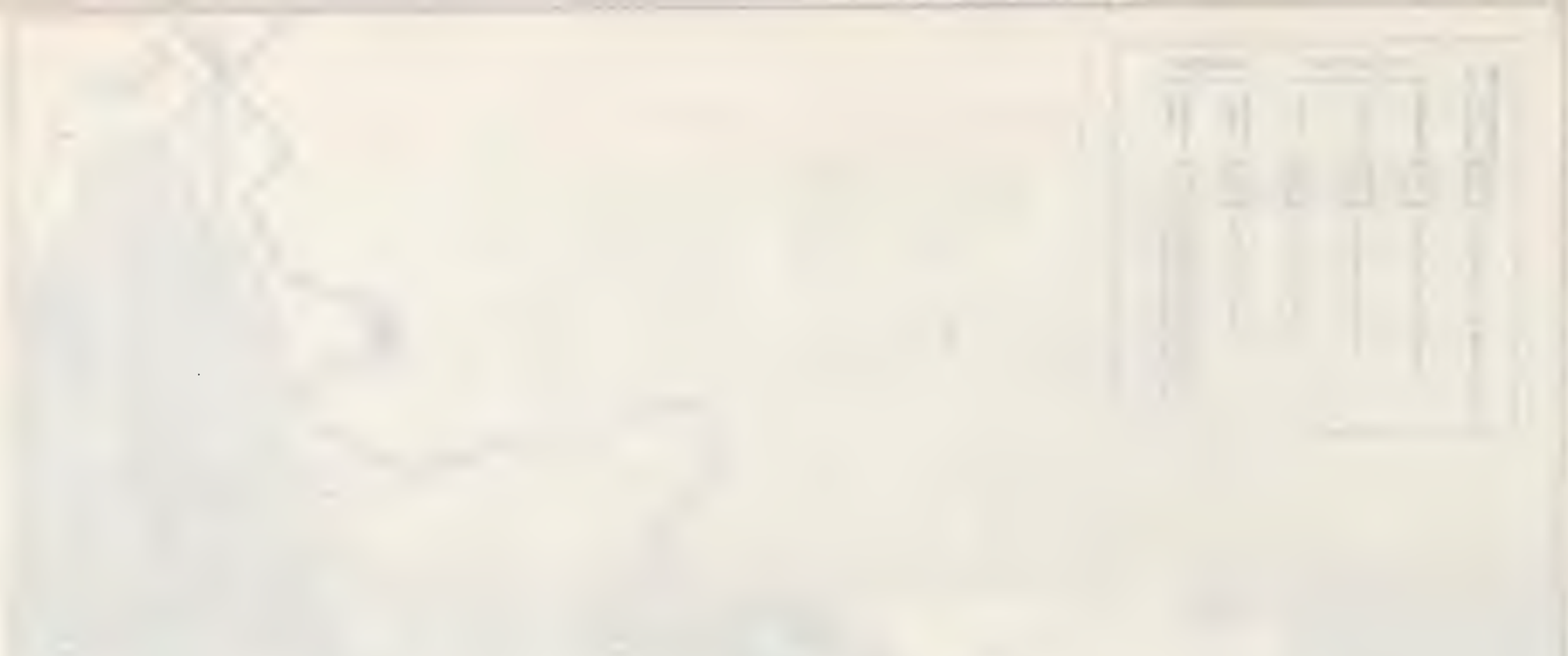
Nolan

Theresa

Boomers Hole

To Mt Mulgrave

16°45' (Approx.)



QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 305

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 15. P.D.T.S. No. 5 MINE AREA, BOX FLAT

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SUMMARY

Powell Duffryn Technical Services Ltd. recommended that drilling be undertaken to test the Bluff Seam in No. 5 Mine Area, which is centred on the abandoned Box Flat Colliery. Twelve holes totalling 11,020 ft. were drilled, three of them actually being located in the adjacent No. 1 Mine Area.

Geological features of the Triassic and younger formations as they occur in the area are described; particular reference is made to the coal seams of the Blackstone Formation and their correlation with the sequence in other parts of the field. Consideration is also given to the geological structure of the area, since three major faults intersect here.

Principal reserves of coal lie in the Bluff Seam, which exists throughout the area but shows a progressive northward deterioration. "Measured" reserves amount to 7,680,000 tons and contain an average of 34·7 per cent ash. Washability tests indicate that to reduce the ash content to the currently acceptable level of 23 per cent an average of 20·1 per cent must be discarded.

"Measured" reserves in the Rob Roy Seam amount to 450,000 tons containing an average of 29·8 per cent ash. Washing to produce coal of 23 per cent ash would necessitate a discard of 15·7 per cent. These reserves occupy a strip along the north-western side of the area. Workable coal may also exist in the poorly tested area between No. 5 Mine Area and No. 8 Mine Area and further drilling is required in this interval.

"Indicated" reserves in the Four Feet Seam lie between two abandoned collieries on that seam and are estimated as 970,000 tons containing about 30 per cent ash.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD
PART 15. P.D.T.S. No. 5 MINE AREA, BOX FLAT

I. INTRODUCTION

P.D.T.S. No. 5 Mine Area lies from a half to one mile south of the township of Blackstone. It is a roughly triangular area bounded on the north-west by the Aberdare Fault, on the south by the Mafeking–Extended Fault, and on the north-east mainly by the outcrop of the Bluff Seam. Powell Duffryn Technical Services Limited recommended that drilling be undertaken in this area to test the Bluff Seam which was expected to exist in a workable condition beneath the worked-out Aberdare Seam.

The area is centred on the old Box Flat Colliery, but also embraces parts of the adjoining Aberdare, Fairbank, Bogside No. 1, Mafeking and Aberdare Extended No. 2 Collieries now abandoned. It is adjoined to the south-west by P.D.T.S. No. 1 Mine Area, in which the planned programme of drilling in 1950-51 was for certain reasons not completed. Drilling in No. 5 Mine Area was therefore extended into the northern part of No. 1 Mine Area, where the objective included the seams below the Bluff.

Drill core was logged by the writer and other members of the Geological Survey staff. The geological mapping is principally the work of L. G. G. Pearce; certain sections were mapped by R. W. Battaglene and E. S. Chiu Chong, and a few details by the writer.

The report is accompanied by the following plans:—

Figure 1. Plan showing topography, surface geology and boreholes. Locality Plan.

Figure 2. Plan showing mine workings, boreholes, P.D.T.S. Mine Area and limits of estimated reserves.

Figure 3. Cross sections.

Figure 4. Generalised borehole sections.

Figure 5. Detailed sections of Unnamed, New Found Out and Aberdare Seams.

Figure 6a and 6b. Detailed sections of Bluff Seam.

Figure 7. Detailed sections of Wright and Lagoon Seams.

Figure 8. Detailed sections of Rob Roy and Four Feet Seams.

Figure 9. Structure contour plan of Bluff Seam.

II. DIAMOND DRILLING PROGRAMME

Drilling by the Department of Mines commenced on 2nd July, 1957, and continued until 21st May, 1958. Twelve holes were drilled, totalling 11,020 ft. 0 in., inclusive of two deflections. Nine of these holes were in No. 5 Mine Area and totalled 7,112 ft. 1 in.; three were in No. 1 Mine Area and totalled 3,907 ft. 11 in. The holes were numbered N.S. 168, 172, and 174 to 183.

Machines used were a Joy 125, which drilled seven holes; a Failing 2500, which drilled three holes and deepened one other; and a Mindrill A3000, which drilled one hole and commenced one other.

In anticipation of difficulties in drilling through the abandoned mine workings, an attempt was made to site holes to pass through pillars. However, as differences between old mine plans made the exact positions of pillars uncertain, and as the condition of pillars had deteriorated since abandonment, penetration of the Aberdare Seam was seldom effected without difficulty. Drilling mud was usually lost as the workings were penetrated, but circulation was restored when casing was seated below the workings.

Two holes, N.S. 180 and 182, were used for electric logging tests by Mines Administration Pty. Ltd. using a Failing "Logmaster" well-logger. Both holes were logged for resistivity, self-potential and temperature, and in addition a radioactivity log was run in N.S. 180. Graphic logs were supplied by the operators but no detailed interpretation was made. Variations within coal seams and other lithologic units were reflected in the resistivity and self-potential logs, but the detail recorded in coal seams was not comparable with that obtainable by visual logging.

III. GEOLOGICAL SUCCESSION

(a) Ipswich Coal Measures

(i) Cooneana Formation.—The Cooneana Formation, of sandstone with interbedded shale and siltstone, occupies the north-eastern corner of the area under consideration. Outcrops are few and poor owing to a widespread cover of soil and semi-consolidated alluvial material. Eight of the twelve holes were drilled into the uppermost sandstone member of the formation through the 10 to 30 ft. of shale which invariably underlies the Rob Roy Seam. Characteristically the sandstones display a tendency to coarseness and contain a notable proportion of dark lithic grains.

(ii) Blackstone Formation.—Ranging in thickness from 620 ft. to 750 ft., the Blackstone Formation here consists of the typical sequence of interbedded shales, siltstones and sandstones. The change in seam sequence from that of the northern part of the district to that of the southern part takes place within this area. Although all of the known seams of the formation are developed to a greater or less degree, no single borehole succeeded in penetrating the combined sequence. In the northern half of the area the sequence is, in descending order:—

New Found Out
Aberdare (Top and Bottom sections)
Bluff
Four Feet (including Four Feet Top Coal)
Bergin
Striped Bacon
Rob Roy

Southwards, the Four Feet and Bergin Seams disappear from the sequence, while the Wright and Lagoon Seams develop and another seam (as yet unnamed) appears above the New Found Out Seam. At the same time the Striped Bacon and Rob Roy Seams unite to form a thick banded seam in which neither component is separately recognizable. In the southern part of the area the seam sequence is therefore:—

Unnamed
New Found Out
Aberdare (Top and Bottom sections)
Bluff
Wright
Lagoon
Striped Bacon–Rob Roy

Across the centre of the area and within a strip of ground coinciding roughly with the course of the Extended–Mafeking Fault, neither the northern nor the southern seam sequence is fully developed. The Four Feet and the Bergin have vanished and the Wright and the Lagoon have not yet appeared. This precludes a completely satisfactory correlation of the two sequences. However, in accordance with evidence from the Blackheath area (Hawkins, 1958a) about a mile to the east on the opposite flank of the Bundamba Anticline, it is considered that the Wright Seam is the uppermost of these four and next underlain by the Four Feet Seam. The relationship of the Bergin and Lagoon Seams is not clear. In N.S. 176 the barrenness of the section below the Bluff Seam is illustrative of this zone of non-deposition of coal.

In the neighbourhood of this zone, irregularities in deposition have resulted in some abnormal intervals between seams. A lens of massive sandstone about 100 ft. thick interposed between the Bluff and Wright Seams in N.S. 180 has increased the Bluff–Wright interval to 208 ft. from a normal 100 ft., and at the same time has reduced the Aberdare–Bluff interval to 53 ft. from a normal 100 ft. by raising the relative position of the Bluff Seam (Figure 3, Section B–B'). This lens also appears in N.S. 178 where it is about 30 ft. thick: the Bluff–Wright interval is still above normal at 143 ft. and the Aberdare–Bluff interval below normal at 62 ft.

(b) Bundamba Group

(i) Aberdare Conglomerate.—The Aberdare Conglomerate is strikingly developed over an extensive dip-slope on the south-western flanks of Blackstone Hill, where the conglomerates, grits and coarse sandstones typical of this formation may be seen. Southeastwards, however, the rocks rapidly lose their rudaceous character and it becomes difficult, if not impossible in places, to differentiate them from the overlying Bundamba sandstone. Within P.D.T.S. No. 5 Mine Area there is hardly an outcrop of true conglomerate, and boreholes indicate that this condition continues for at least 30 chains to the dip. Further south-west conglomerate is again well developed.

Occurring with the conglomerate, and treated as part of the formation, there is a bed of ferruginous shale which generally crops out as a massive, iron-stained, light-grey shale intersected by a network of ferruginous veinlets. In drill core this rock is identified as the "pink" shale carrying iron carbonate grains which is seen at this horizon in other parts of the field. In the absence of the rudaceous elements of the Aberdare Conglomerate, identification of the formation is sometimes dependent on this ferruginous member.

The unconformable junction between the Aberdare Conglomerate and the Blackstone Formation was exposed by workings from Aberdare Nos. 1 and 2 Tunnels where the New Found Out Seam had been washed out and replaced by the basal conglomerate.

(ii) Bundamba Sandstone.—The "lower Bundamba Sandstone" (Wilson, 1960), with its high proportion of interbedded siltstone, occurs in the area but is largely obscured by alluvium. It is about 450 ft. thick and contains one named coal seam, the Little West Moreton. The "upper Bundamba sandstone" (Wilson, 1960), consisting of at least 200 ft. of massive, white, fine- and medium-grained sandstone, was penetrated by N.S. 183 but does not crop out, being overlain by alluvium and Tertiary strata.

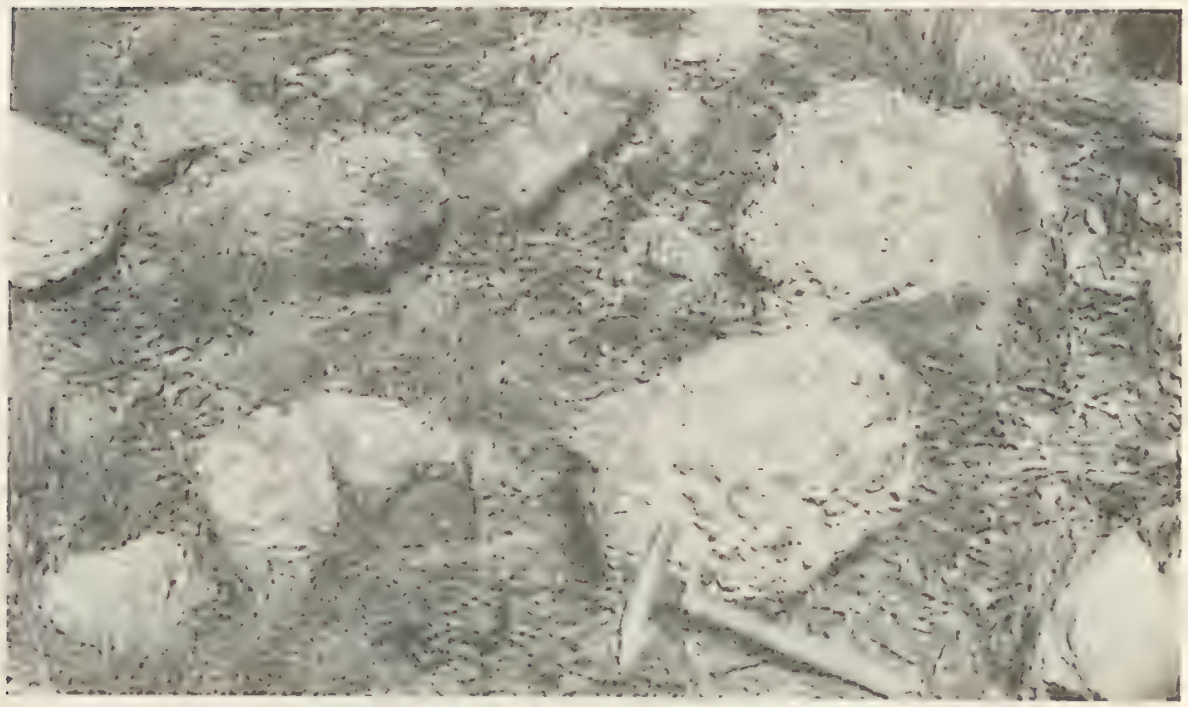
(c) Post-Mesozoic Sediments

The Redbank Plains Formation of Eocene or Oligocene age, comprising variously coloured shales and mudstones with minor sandstone, occupies a strip in the south-west corner of the area and is overlain by basalt of the Silkstone Formation that crops out near N.S. 183.

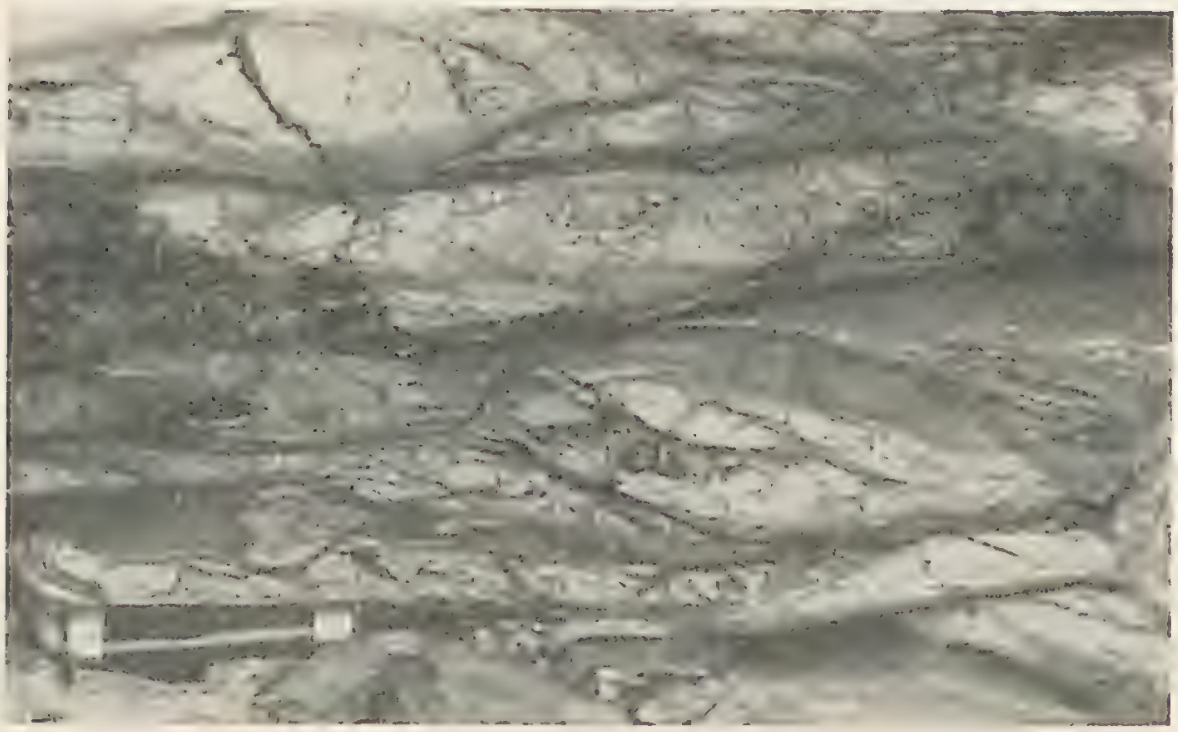
Alluvium of broad lateral extent, although apparently little thicker than 10 ft., covers the flood plain of Bundamba Creek and obscures the older formations.

A deposit of semi-consolidated sandy alluvial material in the north of portion 296 has obviously been derived from the sandstones of the Cooneana

South-westerly view of Blackstone Hill (Triassic formations) with flat topography of Tertiary formations in foreground.

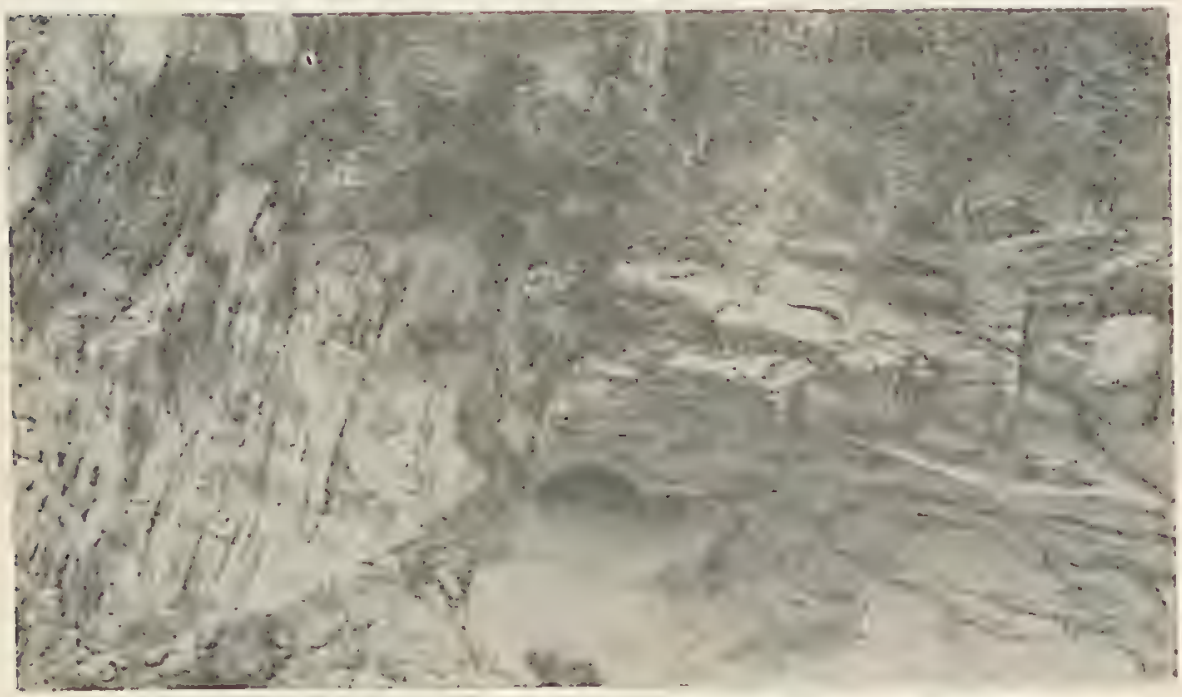


Aberdare Conglomerate, por. 270, Goodna.



Ferruginous shale member of Aberdare Conglomerate formation, showing typical appearance at outcrop; por. 286, Goodna

Alluvium overlying Cooneana Formation, in creek-bed near western boundary of por. 283, Goodna.



Steeply-dipping strata lying against horizontal strata in zone of Aberdare Fault; roadway between pors. 299 and 183, Goodna.

Ripple marked bedding plane in sediments of Bundamba Group; roadway between pors. 299 and 183, Goodna.

Formation upon which it lies. Stream erosion in the area has formed steep banks up to 10 ft. high in this deposit. It appears to be slightly older than the remainder of the alluvium in the area, but has not been distinguished from it on the geological map.

IV. STRUCTURAL GEOLOGY

The structure of the area is well known from extensive workings on the Aberdare Seam. Contours on the floor of this seam were drawn using reduced levels from boreholes and certain shafts as a control and the network of workings as a guide. By inference, and again using borehole intersections as a control, a plan of structure contours on the floor of the Bluff Seam was prepared (Figure 9), to assist in planning future development.

Folding and faulting in the area are probably of contemporaneous origin. Differential movement has produced quite different fold structures on opposite sides of each major fault; and this has resulted in wide variation in the apparent vertical displacements.

(a) Folding

The strata in this area form part of the western limb of the *Bundamba Anticline,* but the simple anticlinal structure is complicated by subsidiary folding resulting from the intersection of three major faults within the area. In the east of the area strike and dip conform to the normal attitude of this side of the anticline. The beds of the Blackstone Formation here strike approximately NNW.-SSE. and dip WSW. at angles which at the outcrop of the formation range from 20 deg. to 30 deg., flattening down dip. The tendency for the strike to become meridional in the south-east corner is an indication of the saddle-like structure at the middle of the Bundamba Anticline. The central part of the area is disturbed by folding and faulting, but the normal attitude is resumed in the south-west of the area, where the dip flattens to 15 degrees.

Structure contours show two minor anticlines superimposed on the regional structure. One, the *Swanbank Anticline,* is a comparatively sharp structure lying south of the Mafeking–Extended Fault and pitching to the north-west. The other is a broad structure in the north of the area. Virtually horizontal strata just south-west of Blackstone Hill lie on the crest of this anticline. Its axis here runs south-west; near the centre of the area it curves around almost to the south; and it is finally truncated by the West Moreton Fault. The Aberdare Extended No. 2 workings lie astride the southern part of this fold. The complementary syncline is also a broad shallow structure which widens as it runs southwards down the centre of the area. The Box Flat workings lie within this depression.

(b) Faulting

The dominant fault trend is NW.-SE. modified at either end of the Mafeking–Extended Fault by a WNW.-ESE. trend. This pattern is intersected by the weaker NE.-SW. pattern of the Aberdare Fault.

The *Mafeking–Extended Fault* is the break which cuts off workings in the Aberdare Seam in the south of Mafeking and Box Flat Collieries and in the north of Aberdare Extended No. 1 Colliery. Because of alluvial cover and poor outcrops it is known almost solely from these underground exposures. It is a normal fault dipping north-eastwards at an angle which, though unrecorded, is estimated to be 45 degrees. Displacement varies considerably from place to place. In the upper levels of Mafeking Colliery a downthrow of about 100 ft. to the north is indicated by the juxtaposition of the Bluff Seam met in a stone drive through the fault. Owing to steeper dips on the northern side of the fault than on the southern side, the displacement increases to 350 ft. in the north of portion 16 (Figure 3, Section B-B'). North-west from this point change of strike and reversal of dip on the northern side of the fault diminish the apparent displacement until, near the intersection with the West Moreton Fault in portion 220, structure contours indicate that it is only about 100 ft. It increases again westwards to about 300 ft. in portion 22 and to about 500 ft. in portion 224.

The *West Moreton Fault* follows a NW.-SE. course in the west of the area and dips north-east at an unknown though probably steep angle. As the position of the Aberdare Seam in the apex of the wedge-shaped block between this fault and the Mafeking–Extended Fault can only be guessed at, the degree of displacement is also uncertain; it may be of the order of 300 ft. down to the south-west.

The *Aberdare Fault* is a reverse fault traversing the workings of Aberdare Nos. 1, 2 and 3 Tunnels in portion 286 and continuing south-west through the Aberdare Extended No. 2 workings as a series of small parallel faults to meet the West Moreton Fault in portion 182. It dips north-west at 65 deg. Owing to differences in the attitude of the strata on opposite sides of the fault, displacement varies considerably. It attains a maximum of 200 ft. in Aberdare No. 2 Tunnel and diminishes to 100 ft. twenty chains in either direction. The fault vanishes in the north of portion 294.

(c) Structure of Basin

An apparent genetic connection between the sedimentary sequence and the geological structure is worthy of note here. Alternating deposition which produced the two sequences of seams in the middle of the Blackstone Formation has taken place on either side of a central strip which appears to have acted as a pivotal zone between mobile halves of the basin. This strip, extending for some distance into adjacent areas, parallels the NW.-SE. course of the dominant fault pattern of the field. This parallelism suggests the presence of some strong basement feature which has acted as a structural control in earth movements and sedimentation.

V. COAL SEAMS

(a) Little West Moreton Seam

The Little West Moreton Seam, which lies some 200 ft. above the Aberdare Conglomerate, was identified with certainty in only two holes. N.S. 178 passed through a 3 ft. 10 in. section at 294 ft. 9 in. consisting mainly of coal with a few shale bands. In N.S. 183 a highly banded 2 ft. 4½ in. section was intersected at 851 ft. 7½ in.

(b) Unnamed Seam

Drilling in the neighbouring Silkstone area following on from drilling in the Box Flat area discovered a hitherto unknown coal seam lying at the top of the seam sequence in the Blackstone Formation. Correlation of the Silkstone holes with N.S. 183 indicates that an inferior section of this seam probably exists immediately above the New Found Out Seam in N.S. 183 (Figure 5). It is about 18 ft. thick at a depth of 1,164 ft. Successive sections 3 ft. 1¼ in., 4 ft. 0 in. and 5 ft. 0 in. thick, in the lower part of the section, carried 38·8, 43·9 and 37·8 per cent ash respectively. The seam does not crop out and is known only from drillhole sections.

(c) New Found Out Seam

Local improvements of the banded coaly section above the Aberdare Seam were named the New Found Out Seam and were worked from Aberdare Nos. 1 and 2 Tunnels and in Box Flat and Aberdare Extended No. 2 Collieries. These occurrences have been well documented by A. K. Denmead (1955a, pp. 23, 71, 74, 75). He also reported on workings in this seam from a stone drive from Aberdare Extended No. 1 Shaft (*ibid.*, p. 75).

The seam was penetrated in holes N.S. 172, 177, 179, 181, 182 and 183. Holes N.S. 177 and 181 passed through old workings in the seam, but N.S. 172, 179 and 183 penetrated unworked sections. The sections in N.S. 179 and 182 each contained about 5 ft. of clean coal in a much thicker banded section, but this coal would not be available for extraction owing to the proximity of extensive abandoned workings in the underlying Aberdare Seam. The section in N.S. 183 which corresponds to the section worked in the Aberdare Extended No. 1 stone drive workings is 9 ft. 7 in. thick and is continuous with the overlying Unnamed Seam. It was analysed in three nearly equal sections which contained 18·5, 17·3 and 18·2 per cent ash respectively (Figure 5).

A remarkable feature about the New Found Out Seam is the suddenness with which it disappears from the stratigraphic sequence. The section worked in the stone drive workings lies at the base of a 35 ft. section penetrated by the earlier Aberdare Extended No. 1 diamond drill hole, but this whole section is quite unrepresented in Aberdare Extended No. 1 Shaft only 13 chains away. In N.S. 178 there is no coal whatever in the 93 ft. interval between the Aberdare Seam and the Aberdare Conglomerate. Denmead 1955a, p. 74) has drawn attention to the seam's absence from the Aberdare Extended No. 2 Shaft despite the fact that it was worked to within one chain of the shaft. However, a reported 15 ft. of coal measures overlying the Aberdare Top Seam in the shaft probably includes a deteriorated remnant of the New Found Out Seam.

(d) Aberdare Seam

Formerly the most important seam on the Ipswich coalfield because of its quality and thickness, the Aberdare Seam has been worked throughout the area under review. The principal colliery was Box Flat, which was adjoined on the north by the workings of Aberdare Nos. 1, 2 and 3 Tunnels and Fairbank Colliery; on the east by Bogside Colliery; on the south by Mafeking Colliery; on the south-west, across the Mafeking–Extended Fault, by the extensive Aberdare Extended No. 1 Colliery; and on the west by Aberdare Extended No. 2 Colliery. Features of the Aberdare Seam in each of these collieries have been well summarised by Denmead (1955a) and there is little more to record here.

As all holes drilled in this area had to pass through old workings on this seam a full section of the seam was seldom cored. In N.S. 178 and 180, which were drilled through large pillars in the Aberdare Extended No. 1 workings, almost complete recovery was obtained. These sections, stored in the Mines Department core library at Redbank, now constitute a tangible record of the Aberdare Seam in this area where otherwise it could not be viewed (Figure 5).

(e) Bluff Seam

The principal objective of the drilling campaign in this area, the Bluff Seam was drilled in all holes except N.S. 174 and 175 (which were sited behind the crop to test underlying seams). In the holes north of the Mafeking–Extended Fault, i.e. within the limits of P.D.T.S. No. 5 Mine Area, the thickness of the seam ranges from 28 ft. 1¼ in. in N.S. 168 to 39 ft. 2½ in. in N.S. 181, and averages nearly 33 ft. The distinctive marker band—a dense, light-grey to creamy-coloured, fissile shale—is present in every section, normally averaging about 15 inches thick and lying from 6 ft. to 9 ft. below the top of the seam.

In N.S. 178 and 180 the Bluff Seam is split into two sections by a wedge of shale intercalated just below the marker band and reaching a thickness of nearly 21 ft. in N.S. 178. Splitting of the seam in these holes is accompanied by serious deterioration which renders all sections unworkable. At the same time the marker band thickens abnormally to 4 ft. 3 in. in N.S. 178 and 10 ft. 1½ in. in N.S. 180.

The seam is at its best in the south of P.D.T.S. No. 5 Mine Area and northward shows a gradual downward deterioration. The full section is of workable quality in N.S. 176, 182A and 181; but in N.S. 172 the top section has disappeared and the middle section is so highly banded as to be unworkable. Only the bottom section persists in good condition throughout the area.

On the evidence of N.S. 178 and 180 a zone of deterioration in the Bluff Seam appears to lie just south of the Mafeking–Extended Fault and roughly parallel to it. The seam improves again to the south-west, for N.S. 183 cored a 37 ft. 7½ in. section containing workable sections in "Tops", "Middles" and "Bottoms" totalling 28 ft. 9½ in. and averaging 30·4 per cent ash. This section is apparently continuous with similar sections previously drilled in N.S. 27, 26 and 14.

The Bluff Seam was worked to a small extent in Noblevale No. 5 Colliery. Mr. J. Stewart, Manager of Bogside No. 2 Colliery, supplied the information that the seam was 27 ft. 3½ in. thick, and that the section worked was the bottom 4 ft. 8 in. (including 1 ft. 5½ in. of "brushings"). A section of 29 ft. 4 in. was measured by the writer in an exploratory shaft on the eastern boundary of sub. 1A of portion 286. Part of this section has lately been opened up in Bogside No. 3 Colliery.

A short drilling programme undertaken by Queensand Industries Pty. Ltd. in 1951-52 included one hole (No. 5) in the east of por. 299, one (No. 6) in the south-west corner of por. 298 and another (No. 1) near the eastern boundary of por. 270.

These holes passed through thicknesses of 25 ft. 6 in., 30 ft. (approximately) and 28 ft. respectively. Only 25 per cent of the seam was recovered from hole No. 6, and the available records of the seam in the other two holes are not sufficiently detailed for satisfactory comparison with Mines Department borehole sections.

(f) Wright Seam

The Wright Seam was penetrated in holes N.S. 178, 179, 180, 183 and doubtfully in N.S. 176, and was absent from the sequence in N.S. 168, 172 and 177 in the north of the area. It reaches its greatest thickness of 30 ft. 7 in. in N.S. 179 where, however, it is a quite unworkable succession of shale and coal bands. The greater thickness may be attributable, at least in part, to faulting. South of the Mafeking–Extended Fault two holes out of three passed through sections in this seam which with washing would be workable. In N.S. 178, where the seam is 22 ft. 2¼ in. thick, 8 ft. 8½ in. in the top section contains 33·6 per cent ash and 7 ft. 7¾ in. in the bottom section contains 33·5 per cent ash. This section thickens towards N.S. 183 where the seam totals 23 ft. 8¼ in. The top 12 ft. 1¼ in. contains 31·0 per cent ash and the bottom 10 ft. 2½ in. 36·8 per cent ash (Figure 7).

A distinctive feature of the Wright Seam in this section of the field is the presence of three fawn shale bands each from 2 in. to 4 in. thick within about 15 in. at the middle of the seam.

The seam is not worked, nor does it crop out within this area. However, about half a mile to the south of N.S. 176 the main adit of Southern Cross No. 10 Colliery is driven on the outcrop of the Wright Seam. The working section of 7 ft. 5 in. lies in the top section of the seam and is separated by 5 ft. 9 in. of shale from 8 ft. of coal and shale bands forming the bottom section.

(g) Four Feet Seam

The Four Feet Seam was worked to about 13 chains from the outcrop in Aberdare No. 4 ("Aspro") Colliery and is currently being exploited in portion 297 and sub. 1A of portion 286 by Bogside No. 2 Colliery. Borehole N.S. 174, located in an unworked block between the Aberdare No. 4 workings and the United No. 2 ("Ladysmith") workings further north-west, penetrated a 25 ft. section of the seam including the Top Coal. The bottom 8 ft. 4½ in. was sampled in two sections—a 5 ft. 6½ in. section below the "double white" marker band, which carried 21·4 per cent ash, and a 2 ft. 10 in. section above and including the marker band, which carried 41·4 per cent ash.

The seam deteriorates southwards; N.S. 172, 177 and 168 cored progressively inferior sections of only 8 ft. to 9 ft. thickness, and in N.S. 179 its presence is doubtful. These facts accord with southward deterioration viewed underground in Bogside No. 2 by the writer (Staines, 1958b) some time before drilling commenced. The seam, worked at thicknesses up to 5 ft. 6 in. in this colliery, thins to 4 ft. 9¾ in. of coaly shale in N.S. 176. It is not known south of the Mafeking–Extended Fault.

(h) Bergin Seam

Little interest attaches to the Bergin Seam in this area as it is quite unworkable and was identified with certainty only in holes in the northern part of the area. Towards the crop it is thicker and is split by several feet of shale into top and bottom sections which aggregate 29 ft. 7½ in. in N.S. 174 and 22 ft. 2 in. in N.S. 175.

(i) Lagoon Seam

The Lagoon Seam does not exist in P.D.T.S. No. 5 Mine Area, but develops in P.D.T.S. No. 1 Mine Area south of the Mafeking–Extended Fault. In N.S. 178 and 180 it is 17 ft. 10 in. and 13 ft. 2 in. thick respectively, but neither section contains a workable thickness of coal. In N.S. 183 the thickness increases to 18 ft. 11¾ in. (Figure 7). Quality also improves in this direction: a 5 ft. 5 in. section at the top contains 30·1 per cent ash and an 8 ft. 1½ in. section towards the bottom contains 31·3 per cent ash. This section is probably continuous with sections in No. 1 Mine Area included in reserves in the Swanbank Lagoon area (Denmead, 1955b).

(j) Striped Bacon Seam

Although the Striped Bacon Seam is represented in all holes drilled deep enough to intersect it in No. 5 Mine Area (except N.S. 172), it occurs only as a sequence of coal and shale bands about 6 ft. thick some 30 to 50 ft. above the Rob Roy Seam. In N.S. 178 and 180 it appears that the seam has almost doubled in thickness and that the interval between it and the Rob Roy has diminished to only a few feet.

(k) Rob Roy Seam

Lying at the base of the Blackstone Formation, the Rob Roy Seam occurs throughout the area; and is, indeed, the only seam that persists throughout the whole Bundamba-Dinmore mining district. Within P.D.T.S. No. 5 Mine Area its thickness ranges from 2 ft. 10 in. (N.S. 175) to 6 ft. 3 in. (N.S. 174), but in N.S. 178 and 180 it increases sharply to slightly more than 14 ft. As elsewhere, correlation of the seam is facilitated by the frequency of shale bands of a fawn or brownish colour.

The Rob Roy Seam is at its best along the north-western margin of No. 5 Mine Area, where three holes penetrated a workable section. In N.S. 174 a 4 ft. 10½ in. section contains 26·1 per cent ash; in N.S. 172 a 5 ft. 2 in. section contains 32·9 per cent ash; and in N.S. 177 a 5 ft. 3½ in. section contains 30·5 per cent ash (Figure 8). Coal of similar or better quality may exist in this seam in the poorly tested area between No. 5 Mine Area and the nearest holes in No. 8 Mine Area nearly a mile to the north.

The thickening and close approach of the Striped Bacon and Rob Roy Seams towards the south of the area under review are considered to be the prelude to their ultimate merging as a single thick banded seam. Such a seam occurs at the base of the Blackstone Formation in the Swanbank Lagoon (Denmead, 1955b), United No. 5 (Staines, 1959), Southern Cross No. 9 (Staines, 1958a) and New Hope (Hawkins, 1958b) areas, and has been referred to as the "(?) Rob Roy Seam". There is now little doubt that it is the combined Striped Bacon and Rob Roy Seams.

VI. RESERVES

Calculation of reserves has been based on the assumption that workable coal extends for a distance of five chains beyond an outer borehole showing a workable section, unless there is evidence to the contrary. No allowance is made for loss of coal through faulting or through other causes during mining. Outlines of reserves are shown on Figure 2.

Although drilling reported on herein is located in both Nos. 5 and 1 P.D.T.S. Mine Areas, reserves are quoted only for No. 5 Mine Area. Additional reserves are indicated in the northern part of No. 1 Mine Area by workable sections of the Bluff, Wright and Lagoon Seams in N.S. 183 and the Wright Seam in N.S. 178. The full sections of these seams were sampled with a view to the coal being washed upon eventual extraction. However the corresponding seams in N.S. 27, 26 and 14, the nearest holes in the earlier No. 1 Mine Area drilling programme, were sampled only in those sections considered at that time to be workable without washing. As washing was not then widely practised, no washability tests were carried out. Comparison of analytical results in the two groups of holes is therefore difficult. It is proposed to defer assessment of reserves in this locality until reserves are being estimated in the Raceview-Ripley Road area on completion of drilling there.

(a) Bluff Seam

As the thickness of this seam is much greater than could be worked in a single underground operation the seam was sampled in sections of thickness comparable with what was considered to be a convenient underground working height, viz., 6 to 8 feet. Stratigraphic correlation of sampled sections from hole to hole was preserved in order to present clearly the variations in thickness and quality of each section. The seam was thus divided into "Tops", "Middles (i)", "Middles (ii)", and "Bottoms". Reserves have been estimated in each of these sections. A fifth section appears below the Bottoms in two holes, but contains no measurable reserves.

Average ash content of the seam is fairly high, being greater than 30 per cent in each section. Washability tests were carried out on all samples at specific gravities of 1·4, 1·6 and 1·8. It was found that washing at specific gravity 1·8 reduced the ash content to an unnecessarily low figure, in some cases well below 20 per cent. A higher specific gravity could be used to obtain a still marketable product.

An alternative method of assessing the workability and washability of the seam was suggested by the Fuel Technologist of the Queensland Coal Board, Mr. J. Norman. By applying a corrective factor to the analytical figures, Mr. Norman calculated for each sample the quantity to be discarded in order to reduce the ash content to a uniform 23 per cent, this being the figure currently aimed at by operators of coal-washing plants on the Ipswich field. A discard of about 40 per cent was then adopted as the allowable maximum for a section to be considered as workable.

The following table summarises "measured" reserves in the Bluff Seam as calculated on the above basis:—

Section	Average Thickness	Area (acres)	Volume (acre-feet)	Average S.G.	Average Ash (per cent)	Tons	Washability	
							Discard* (per cent)	Tons remaining
Tops	6 ft. 8 in.	58·0	386·3	1·59	33·2	740,000	16·9	620,000
Middles (i)	7 ft. 4½ in.	157·6	1,161·5	1·62	35·8	2,290,000	22·5	1,770,000
Middles (ii)	6 ft. 1½ in.	157·6	966·1	1·69	38·3	1,980,000	27·0	1,450,000
Bottoms	7 ft. 2½ in.	188·5	1,359·1	1·62	31·5	2,670,000	14·1	2,300,000
Whole seam ..			3,873·0	1·63	34·7	7,680,000	20·1	6,140,000

* Percentage by weight to be discarded during washing to reduce ash content to 23 per cent.

Reserves in the Top section of the seam are based on three almost collinear holes. Measurement of reserves is considered justified because of their probable southward continuation as far as the Mafeking–Extended Fault.

(b) Wright Seam

As mentioned above, there are additional "indicated" reserves in the northern part of P.D.T.S. No. 1 Mine Area, but they will not be evaluated until further drilling is done.

(c) Four Feet Seam

"Indicated" reserves are quoted for this seam in an area lying west and north-west of the abandoned Aberdare No. 4 Colliery and extending towards the abandoned United No. 2 Colliery. Sections of 5 ft. 9 in. and 5 ft. 7½ in. respectively are figured for the seam in these collieries by Denmead (1955a). Although lesser thicknesses were worked formerly, the full thickness would appear to be workable under present-day conditions. This is supported by an 8 ft. 4½ in. section in N.S. 174 averaging 28·2 per cent ash and a 5 ft. 8 in. section in N.S. 172 averaging 34·1 per cent ash.

"Indicated" reserves underlie an area of 90 acres. On the assumptions that thickness averages 5 ft. 9 in. and specific gravity averages 1·55, tonnage is estimated to be 970,000.

(d) Lagoon Seam

As with the Bluff and Wright Seams, reserves are indicated in the northern part of P.D.T.S. No. 1 Mine Area by a workable section in N.S. 183; but their tonnage will not be estimated at this stage.

(e) Rob Roy

Coal of workable quality disclosed in the Rob Roy Seam by three nearly collinear holes in the north-west of the area is taken as the basis of "measured" reserves in this seam, as it is probably an extension of workable coal in P.D.T.S. No. 8 Mine Area. Reserves amount to 450,000 tons, underlying an area of 47·5 acres. The average seam thickness is 5 ft. 1 in. and the average ash content is 29·8 per cent. Using the methods applied in assessing the washability of the Bluff Seam it is estimated that a product containing a uniform 23 per cent ash could be obtained by discarding 15·7 per cent during washing. Tonnage available after washing is therefore 380,000.

VII. CONCLUSIONS

The Aberdare Seam having been worked out in this area, the Bluff Seam now offers the best prospects for development. Although the complete seam is not continuous over the whole area (there being a progressive northward deterioration) it contains "measured" reserves totalling 7,680,000 tons and carrying an average of 34·7 per cent ash. Reserves lie in four separately considered sections of the seam ranging in thickness from 6 ft. 1½ in. to 7 ft. 4½ in. Because of the high ash content, coal will need to be washed before sale. Washability tests indicate that to reduce the ash content to the currently acceptable level of 23 per cent an average of 20·1 per cent of the material mined would be discarded.

"Measured" reserves in the Rob Roy Seam amount to 450,000 tons carrying an average of 29·8 per cent ash. Washing to produce coal of 23 per cent ash would necessitate a discard of 15·7 per cent.

"Indicated" reserves in the Four Feet Seam amount to 970,000 tons with an ash content approximating to 30 per cent.

The area between P.D.T.S. Nos. 5 and 8 Mine Areas has been inadequately tested below the Aberdare Seam and may contain additional reserves of coal in the Rob Roy Seam extending from "measured" reserves in the north-west of the area under consideration. Further drilling is required in this adjacent area.

Whereas it had been hoped that drilling in this area would incidentally solve certain problems of correlation between the two groups of seams in the middle of the Blackstone Formation, this hope was not in fact realised. Instead, the drilling showed that there is a zone traversing the area in which both groups of seams have failed to develop.

Construction of structure contours on the Aberdare and Bluff Seams has given a clearer picture of the geological structure of this section of the Ipswich coalfield and has clarified to a certain extent the nature of the displacements across the three major faults in the area.

VIII. REFERENCES

DENMEAD, A. K., 1955a: The West Moreton (Ipswich) coalfield. *Geol. Surv. Qld Publ., 279.*

————, 1955b: Coal resources, West Moreton (Ipswich) coalfield. Part 1. P.D.T.S. Nos. 1, 2 and 3 mine areas, Swanbank Lagoon. Part 2. P.D.T.S. Nos. 7 and 8 mine areas, Bundamba. *Geol. Surv. Qld Publ., 280.*

HAWKINS, B. W., 1958a: Coal resources, West Moreton (Ipswich) coalfield. Part 8. P.D.T.S. Nos. 9 and 10 mine areas, Blackheath–Bonnie Dundee. *Geol. Surv. Qld Publ., 288.*

————, 1958b: Coal resources, West Moreton (Ipswich) coalfield. Part 10. P.D.T.S. No. 4 mine area, New Hope. *Geol. Surv. Qld Publ., 289.*

STAINES, H. R. E., 1958a: Coal resources, West Moreton (Ipswich) coalfield. Part 9. Southern Cross No. 9 mine area. *Geol. Surv. Qld Publ., 289.*

————, 1958b: Bogside No. 2 Colliery area, Ipswich coalfield. *Qld Govt Min. J., 59,* 290-294.

————, 1959: United No. 5 mine area, Ipswich coalfield. *Qld Govt Min. J., 60,* 116-121.

WILSON, E. G., 1960: Bundamba Group. In *Geology of Queensland. J. Geol. Soc. Aust., 7,* 257-258.

TABLE 1

DETAILS OF WASHABILITY TESTS AND ANALYSES

Seam	Section	Hole	Sample No.	Washability Tests								Analysis of Composite of Floats at S.G. 1·4, 1·6, 1·8								
				Floats S.G. 1·4		Floats S.G. 1·6		Floats S.G. 1·8		Sinks S.G. 1·8		Moist %	Vol. Mat. %	Fixed Carb. %	Ash %	B.T.U. per lb.	Sulphur	Spec. Grav.	Coking Class.	Sw. Index
				Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	Weight %	Ash %									
Bluff ..	Bottoms (i)	N.S. 168	73/58	35·8	7·3	22·7	21·7	15·6	36·4	25·9	70·5	2·5	27·1	52·5	17·9	11,360	0·31	1·464	Cw	1½
Bluff ..	Bottoms (i)	N.S. 172	74/58	25·5	8·5	26·2	21·9	16·6	37·0	31·7	66·8	2·4	27·0	50·3	20·3	10,930	0·34	1·488	Cw	1½
Bluff ..	Tops ..	N.S. 176	75/58	36·1	6·7	26·3	21·1	15·1	34·9	22·5	64·7	2·6	29·5	50·4	17·5	11,510	0·22	1·477	Cw	1½
Bluff ..	Middles (i)	N.S. 176	76/58	40·1	8·7	20·3	23·9	14·0	38·7	25·6	67·0	2·5	28·7	50·2	18·6	11,400	0·23	1·461	Cw	1¼
Bluff ..	Middles (ii)	N.S. 176	77/58	33·9	6·9	16·7	21·2	13·6	37·8	35·8	71·6	2·4	29·0	51·0	17·6	11,420	0·32	1·460	Cw	1¼
Bluff ..	Bottoms (i)	N.S. 176	78/58	43·3	8·4	22·1	22·4	12·2	37·4	22·4	68·3	2·4	28·6	53·2	15·8	11,840	0·32	1·449	Cw	1¼
Bluff ..	Middles (i)	N.S. 177	811/58	34·3	8·4	29·9	26·5	14·2	41·2	21·6	64·6	1·8	25·8	51·2	21·2	10,960	0·39	1·523	Nc	—
Bluff ..	Middles (ii)	N.S. 177	812/58	37·2	9·3	20·3	24·1	14·0	42·2	38·5	70·3	2·6	25·3	50·5	21·6	10,660	0·29	1·556	Nn	—
Bluff ..	Bottoms (i)	N.S. 177	813/58	33·3	6·9	23·3	22·8	13·0	38·9	30·4	66·7	2·1	27·2	52·3	18·4	11,370	0·38	1·438	Af	—
Bluff ..	Tops ..	N.S. 181	814/58	38·9	8·5	15·5	25·0	7·3	42·5	38·3	73·7	2·3	27·6	53·4	16·7	11,770	0·28	1·483	Af	—
Bluff ..	Middles (i)	N.S. 181	815/58	32·1	10·0	21·5	26·2	9·6	43·7	36·8	72·3	2·1	26·0	51·4	20·5	11,260	0·27	1·435	Af	—
Bluff ..	Middles (ii)	N.S. 181	816/58	31·3	6·8	17·7	24·8	9·7	42·3	41·3	74·4	3·3	25·9	52·3	18·5	11,210	0·37	1·529	Nc	—
Bluff ..	Bottoms (i)	N.S. 181	817/58	40·1	7·0	20·4	24·9	11·7	41·9	27·8	71·2	2·3	19·9	60·1	17·7	11,400	0·33	1·413	Nc	—
Bluff ..	Bottoms (ii)	N.S. 181	818/58	42·9	7·8	18·8	23·4	11·8	40·2	26·5	65·7	2·6	25·1	55·3	17·0	11,550	0·33	1·417	Nn	—
Bluff ..	Tops ..	N.S. 182A	819/58	44·0	7·5	21·3	25·0	10·5	41·3	24·2	69·3	2·1	27·5	53·6	16·8	11,790	0·87	1·408	Af	—
Bluff ..	Middles (i)	N.S. 182A	821/58	40·2	7·2	22·9	23·9	10·7	37·5	26·2	74·0	1·7	25·7	55·6	17·0	11,580	0·26	1·410	Nc	—
Bluff ..	Middles (ii)	N.S. 182A	822/58	44·9	4·7	18·5	22·7	9·7	37·8	26·9	68·3	1·7	28·4	56·1	13·8	12,250	0·30	1·382	Af	—
Bluff ..	Bottoms (i)	N.S. 182A	823/58	44·1	6·1	20·6	20·5	7·3	41·4	28·0	71·1	2·4	25·7	58·0	13·9	12,110	0·27	1·394	Nc	—
Bluff ..	Tops ..	N.S. 183	994/58	53·8	8·9	10·6	23·1	8·7	39·4	26·9	71·0	2·0	28·3	54·7	15·0	11,820	0·32	1·403	—	—
Bluff ..	Middles (i)	N.S. 183	997/58	35·8	8·3	25·2	21·4	10·4	39·8	28·6	66·6	2·6	27·8	52·5	17·1	11,630	0·34	1·419	—	—
Bluff ..	Middles (ii)	N.S. 183	998/58	34·3	7·3	23·2	20·4	11·6	40·4	30·9	66·2	2·6	27·7	52·2	17·5	11,490	0·31	1·420	—	—
Bluff ..	Bottoms (i)	N.S. 183	999/58	49·3	7·8	18·2	21·1	6·2	36·4	26·3	70·4	2·2	29·1	55·2	13·5	11,250	0·30	1·380	—	—
Wright ..	Tops ..	N.S. 178	1000/58	40·3	9·5	18·2	24·7	11·6	39·5	29·9	70·0	2·0	28·4	51·3	18·3	11,570	0·31	1·421	—	—
Wright ..	Bottoms ..	N.S. 178	1001/58	43·6	8·0	16·8	24·9	8·1	41·5	31·5	68·0	2·0	29·1	52·5	16·4	11,850	0·30	1·406	—	—
Wright ..	Tops ..	N.S. 183	1002/58	45·8	8·4	18·6	24·2	9·5	40·9	26·1	73·0	2·0	27·4	54·0	16·6	11,780	0·46	1·410	Af	1
Wright ..	Bottoms ..	N.S. 183	1003/58	41·4	10·0	15·7	26·9	8·7	43·7	34·2	72·6	2·1	27·5	51·9	18·5	11,560	0·38	1·417	Af	1
Four Feet ..	Main Seam	N.S. 172	1508/61	*	*	60·7	17·3	13·7	40·0	25·6	68·4	2·4	27·0	48·8	21·8	10,910	0·31	1·473	Af	1
Lagoon ..	Tops ..	N.S. 183	1004/58	52·0	7·5	14·1	24·5	7·4	41·9	26·5	73·6	2·1	28·7	54·9	14·3	12,370	0·33	1·379	Af/Cw	1
Lagoon ..	Bottoms ..	N.S. 183	1006/58	55·4	8·5	8·4	25·0	7·1	40·0	29·1	72·8	2·2	30·0	54·2	13·6	12,270	0·28	1·378	Cw	1
Rob Roy ..	Whole ..	N.S. 172	79/58	33·1	8·7	21·7	25·4	17·3	40·0	27·9	67·1	2·3	27·6	49·7	20·4	11,240	0·33	1·469	Cw	1½
Rob Roy ..	Whole ..	N.S. 174	80/58	43·1	9·8	21·6	22·2	16·6	38·9	18·7	61·4	2·6	27·8	50·4	19·2	11,510	0·48	1·465	Cw	1½
Rob Roy ..	Whole ..	N.S. 177	993/58	52·1	10·0	11·2	27·6	9·4	40·1	27·3	69·3	1·8	27·6	53·3	17·3	11,750	0·39	1·417	—	—

* No tests made at S.G. 1·4.

S. G. REID, Government Printer, Brisbane

DEPARTMENT OF MINES, QUEENSLAND
PLAN OF

P.D.T.S. No.5 Mine Area
BOX FLAT
IPSWICH COALFIELD

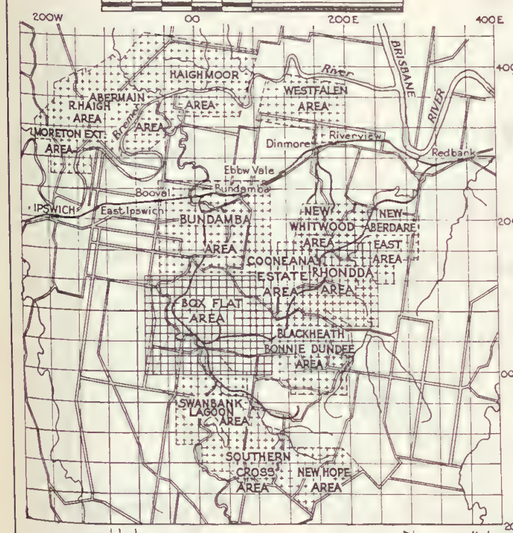
County of Stanley

Showing geology, topography and boreholes

To accompany report by H.R.E.Staines B.Sc., Geologist

SCALE OF CHAINS 10 0 10

LOCALITY MAP
SCALE OF MILES 2½ 2 1½ 1 ½ 0 2½



ABERDARE CONSOLIDATED A
GOODNA
UNITED No.2 A
RYLANCE ABERDARE A
CARDIFF A
HARTS ABERDARE A
WEST MORETON A
ABERDARE No.3 TNL A
FAIRBANK A
ABERDARE No.4 A
ABERDARE No.2 TNL A
ABERDARE No.1 TNL A
ABERDARE EXTD. No.2 A
BOX-FLAT A
NOBLEVALE No.5 A
BOGSIDE No.2
BOGSIDE No.3
ABERDARE EXTD. No.1 A
NOBLEVALE No.3 A
BOGSIDE No.1 A
MAFEKING A
NEW ABERDARE A
SOUTHERN CROSS No.4 A

Q.I.1 1153' Q.I.2 Q.I.5 1054' Q.I.6 450'
Ab. Extd. 2 812' Ab. Extd. 1 1049'
N.S.172 898' N.S.174 N.S.175 N.S.177 925' N.S.168 323' N.S.139 378'
N.S.181 362 N.S.179 1030' N.S.182/A 683' N.S.178 1215' N.S.180 978'
N.S.183 1583' N.S.27 1165' N.S.26 881' N.S.14 N.S.176 1098'

Sheppards Sh. 430 to Aberdare 9
Walkers Sh. 298 to Adare 444 to Bluff
Cummings Tnl.
Stone Tnl.
Aberdare No.1 Tnl.
Aberdare No.2 Tnl.
Aberdare No.3 Tnl.
Aberdare No.4 Tnl.
Bundamba Creek
WEST MORETON FAULT
MAFEKING EXTENDED FAULT
FAULT
FOUR FEET COAL
ROB ROY SEAM
BERGIN SEAM
STRIPPED SEAM
BACON SEAM
BLUFF SEAM
ABERDARE SEAM
Upton Little West Moreton Seam
Reconsolidated alluvium
Soil cover
Scattered sandstone outcrops

SURVEY DATA

Elevations in feet on State Datum. Grid of 20 chain coordinates. Meridian of Grid is True North at origin, an arbitary point being bolt in concrete block on Road near angle in Eastern boundary of Sub.1 of Por.213, Par. of Ipswich.

Survey by Ewan Cowley – Asst. Surveyor

—LEGEND—

QUATERNARY — Alluvium
TERTIARY — Basalt; Redbank Plains Formation
TRIASSIC — Bundamba sandstone; Aberdare Conglomerate; Blackstone Formation; Cooneana Formation

Geological Boundaries :-
Established bdry. posn. accurate
" " " approx.
" " " concealed
Inferred, probable or indef. bdry.

Faults
Established fault posn. accurate
" " " approx.
" " " concealed
Inferred, probable or indef. fault

Coal seam at surface
Outcrop
Diamond drillhole
Percussion drillhole
Section line
Adit
Shaft
Working colliery
Abandoned colliery
BOGSIDE
BOGSIDE A

DEPARTMENT OF MINES, QUEENSLAND
PLAN OF
P.D.T.S. No. 5 Mine Area

BOX FLAT
IPSWICH COALFIELD
County of Stanley

Showing mine workings, limits of reserves and boreholes

To accompany report by H.R.E Staines B.Sc., Geologist

SCALE OF CHAINS 10 0 10

— LEGEND —

- Boundary of measured reserves :-
  - Bluff Seam — Top Section
  - " " — Middle Section
  - " " — Bottom Section
  - Rob Roy Seam
- Boundary of indicated reserves :-
  - Four Feet Seam
- Workings on :-
  - New Found Out Seam
  - Aberdare Seam
    - Top section
    - Bottom section
    - Full section or unrecorded section
  - Bluff Seam
  - Four Feet Seam
- Diamond drillhole
- Percussion drillhole
- Adit
- Shaft
- Fault in workings
- Section line A—A'
- Working Colliery BOGSIDE
- Abandoned Colliery BOGSIDE A

4000W 2000W 0 2000E 4000E 6000E 8000E

12000N 10000N 8000N 6000N 4000N 2000N

ABERDARE CONSOLIDATED A
No.1 Tnl.
UNITED No.2 A
Q1.2 RL Surf. 164·4 RL Btm. -331·60
P.D.6 P.D.5 P.D.4 P.D.3 P.D.2 P.D.1
CARDIFF A
No.2 Tnl.
RYLANCE ABERDARE A
No.6 Tnl.
HARTS ABERDARE A
Records of old Colliery workings Aberdare incomplete.
Q1.10 RL Surf. 306·27 RL Btm. -846·73
Sheppards Sh.
WEST MORETON A
ABERDARE No.3 TNL A
N.S.174 RL Coll. 133·10 RL Surf. 132·74 RL Btm. -113·90
A A'
B B'
C
ABERDARE No.2 TNL A
N.S.172 RL Coll. 111·46 RL Surf. 110·96 RL Btm. -187·54
ABERDARE No.1 TNL A
FAIRBANK A
N.S.175 RL Coll. 136·30 RL Surf. 135·12 RL Btm. -121·53
ABERDARE No.4 A
N.S.177 RL Coll. 138·84 RL Surf. 97·60 RL Btm. -831·24
Walkers Sh.
Ab. Extd. 2 RL Surf. 101·0 RL Btm. -119·5
Q1.5 RL Surf. 89·13 RL Btm. -364·87
N.S.168 RL Coll. 111·40 RL Surf. 106·90 RL Btm. -215·60
Workings on Bergin Seam
ABERDARE EXTD. No.2 A
— P.D.T.S. No.5 MINE AREA —
Cummings Tnl.
N.S.139 RL Coll. 113·85 RL Surf. 112·75 RL Btm. -465·60
BOGSIDE No.2
Ab. Extd. 1 RL Surf. 77·0 RL Btm. -972·0
N.S.181 RL Coll. 104·73 RL Surf. 103·50 RL Btm. -458·77
BOX FLAT A
N.S.179 RL Coll. 86·70 RL Surf. 85·50 RL Btm. -344·05
NOBLEVALE No.5 A
Stone Tnl.
N.S.182/A RL Coll. 91·95 RL Surf. 90·35 RL Btm. -592·55
BOGSIDE No.3
ABERDARE EXTD. No.1 A
N.S.178 RL Coll. 87·89 RL Surf. 83·31 RL Btm. -1132·11
Q1.6 RL Surf. 104·76 RL Btm. -345·24
N.S.180 RL Coll. 92·45 RL Surf. 88·75 RL Btm. -889·38
N.S.176 RL Coll. 112·87 RL Surf. 111·62 RL Btm. -986·56
BOGSIDE No.1 A
N.S.183 RL Coll. 134·69 RL Surf. 130·27 RL Btm. -1452·89
— P.D.T.S. No.1 MINE AREA —
MAFEKING A
N.S.27 RL Surf. 90·10 RL Btm. -1094·6
NOBLEVALE No.3 A
N.S.26 RL Surf. 134·73 RL Btm. -745·85
N.S.14
NEW ABERDARE A
SOUTHERN CROSS No.4 A

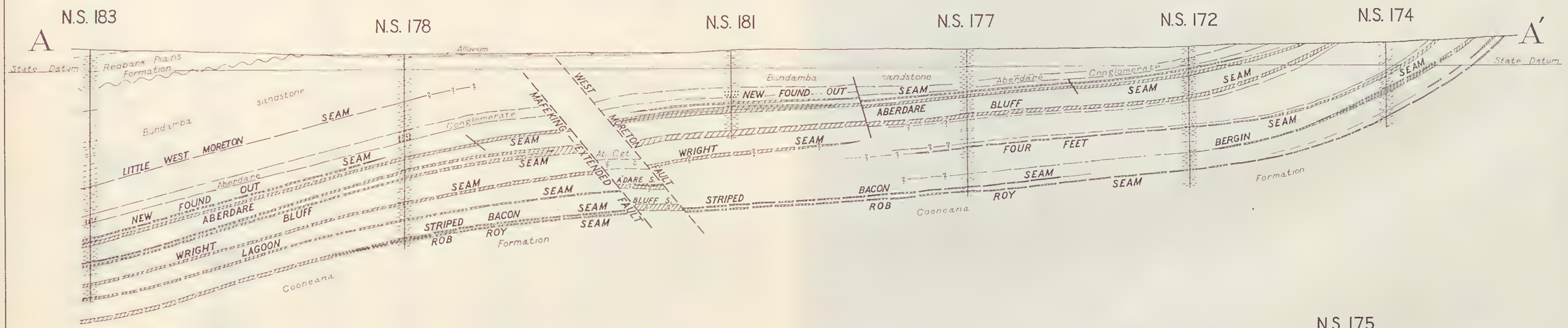
SURVEY DATA

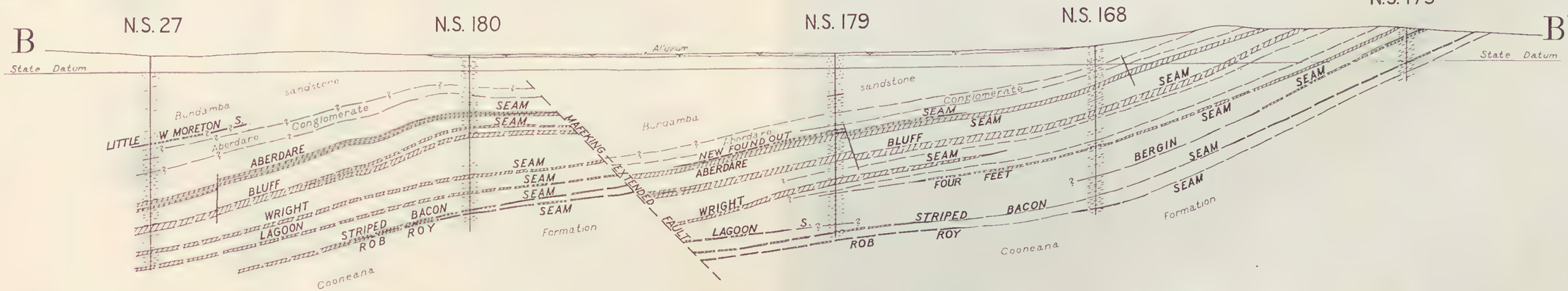
Elevations in feet on State Datum. Grid of 20 chain coordinates. Meridian of Grid is True North at origin, an arbitary point being bolt in concrete block on Road near angle in Eastern boundary of Sub.1 of Por.213, Par. of Ipswich.

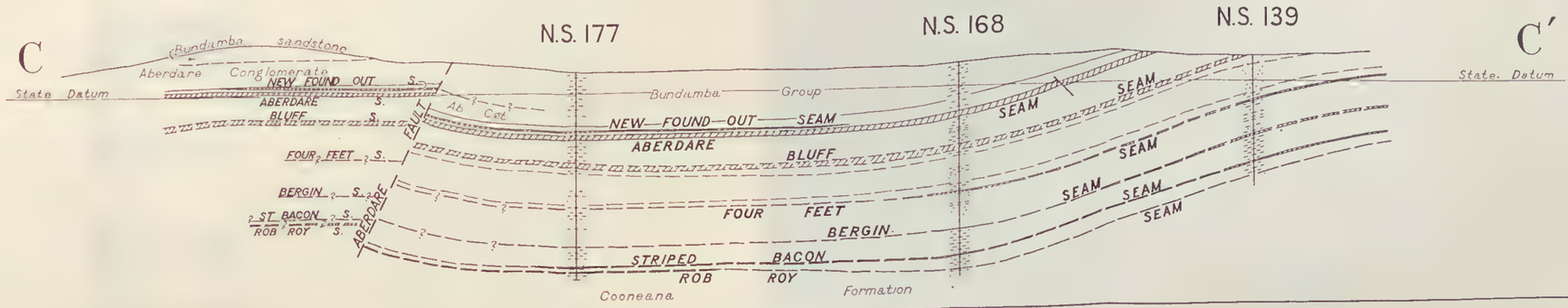
Survey by Ewen Cowley — Asst. Surveyor

P.D.T.S. No. 5 MINE AREA · BOX FLAT · CROSS SECTIONS

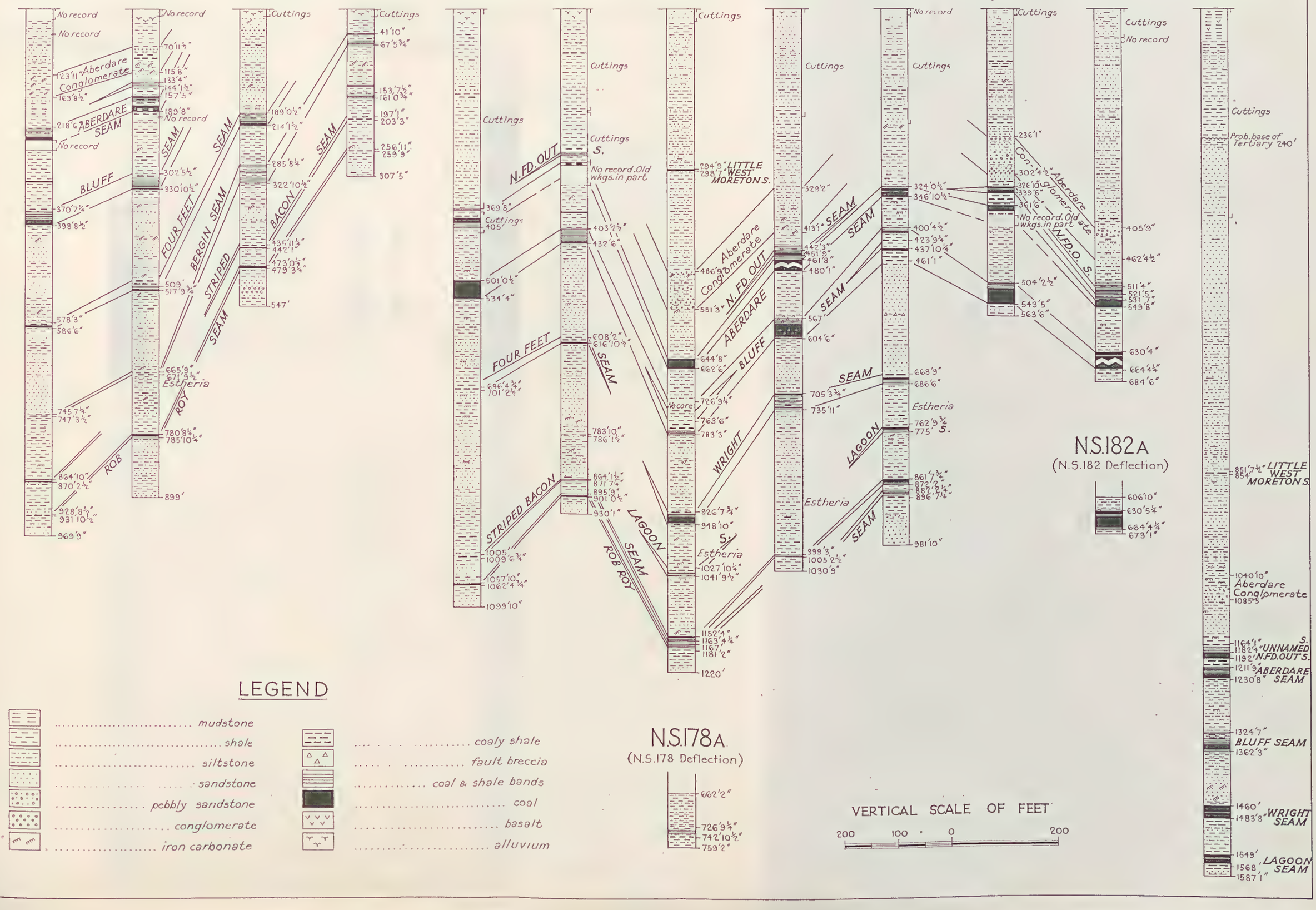
NATURAL SCALE
CHAINS 10 0 10
0 500 1000
FEET







P.D.T.S. No.5 MINE AREA · BOX FLAT
GENERALISED BORE SECTIONS



P.D.T.S. No. 5 MINE AREA · BOX FLAT

DIAGRAMS OF UNNAMED, NEW FOUND OUT AND ABERDARE SEAMS
DETAILS OF CORE RECOVERY AND ANALYSIS

ABERDARE SEAM

N.S. 178

Analysis etc.	Recovery percent	Section Sampled	Seam Section	Description
				4'8" med. dk gy. sh → slts. in places w/ gy. slts. bands in btm 2'.
			644'8"	½" carb. sh. ; ½" dk gy sh
				1¾" carb. sh. w. coal lenses
				9" coal → bluey at 4½ – 5" & in btm. 1"
				1¾" dk gy sh. ; 2½" carb. sh. w sev ¼" coal lenses
				2¾" dk. gy. sh. ; ¼" carb. sh
				1¾" coal ; 1" inf. coal. ; ¾" dk. gy. sh.
				1¼" carb sh → inf. coal ; ¾" dk. gy. sh.
				6¼" carb sh. w. ½" dk. gy. sh at 3".
				5¼" inf. coal ½" gy. sh.
				4½" coal ½" dk. gy. sh.
				1'7" coal w ¾" carb. sh. at 1'1"
				¾" br. sh.
				1'8¼" coal
				½" gy. sh. ; 1¾" carb. sh. w coal lenses
				2" coal 2¼" carb sh
				3" inf. coal w. lenses carb sh. in btm. 1½"
				7½" coal
				1" gy. sh. ; 1" coal 2½" gy. → fn. sh.
				1'1¼" coal
				½" dk gy sh. ; ¾" bluey ; ½" coal
				¼ fn. sh. lens ; ¾" coal ; 1" carb. sh
				2'2" coal w fn. sh. lenses at ¾" – 1½" and w. ½" gy sh. lens at 3".
				1½" bluey ; ½" carb sh. ; ¾" dk. gy. sh
				1" coal ; ¾" fn. sh lens ; 1" carb sh
				4'3¼" coal
				1" inf. coal ; ¾" dk gy. sh ; ½" coal.
				7½" interbd. carb and dk. gy. sh. →
			662'6"	1¾" – 2" inf. coal at 3"
				1¾" coal. 2½" gy. sh.
				1'8" gy. slts. and sh.

Overall Recovery 100 %

N.S. 180

Analysis etc.	Recovery percent	Section Sampled	Seam Section	Description
				7'11½" med – dk gy. sh.
			324'0½"	1⅜" inf. coal
				6¾" coal w. ½" carb sh band at 3"
				1¼" inf. coal ; ¾" carb sh. 2" inf coal
				2" coal ; 2" inf. coal → coal
				2⅝" coal ; 1½" inf. coal
				4" carb sh. 1½" coal
				1'4" carb. sh. w coal lents w inf coal bet. 5" – 7" & bet 10½" – 11½"
				1" inf. coal
				6" coal ½" carb. sh.
				3'1½" coal w. ½" dk. gy sh. at 10½" and 1" carb sh at 1'11".
				1½" carb. sh w coal lents. → inf. coal
				1¼" coal ; ½" dk. gy. sh.
				8" coal ½" fn. sh.
				4¾" coal w ¼" dk. gy. sh. at 2¾"
				1¾" carb sh. ; ½" coal ; ½" carb. sh. ; 2" coal
				1⅜" interbd. carb. sh. and coal
				1¼" coal w. few dk gy sh. penny bds. in btm. ½"
				2'4¾" dk. gy. sh → carb sh. in a few places
				1½" carb sh 1" coal ; ¾" carb sh
				1¾" coal ; 1" carb sh. ; 2" dk gy sh
				½" bluey
				7" coal 3" interbd carb. sh & dk gy sh
				1" coal ¾" carb & dk gy. sh. ;
				2" inf coal → coal w ¼" lgy sh. band at 1"
				¾" lgy & carb sh ; ¾" coal ; 1" inf. coal.
				1'11¼" coal w. ½" carb sh. bands at 1'2½" & 1'9"
				2¾" carb. sh. ; ¾" coal ; ½" carb. sh
				1¾ fn. sh. ; ¾" inf. coal ; ¾" gy sh
				3'10½" coal → inf. in a few places
				3¾" coal w. ¼" carb. sh at 1¼"
				1¼" carb sh ; 1" coal ; 2¼" dk gy sh. → carb. sh. in pl.
				2¾" carb. sh ; 3" interbd. carb sh. & coal in ¼" bds.
				¾" carb sh ; ½" inf. coal
				1¾" interbd. carb sh. & coal ; 3½" coal
				6" dk gy. sh.
			346'10½"	1½" inf. coal
				6'7½" dk gy sh

Overall Recovery 99·5 %

UNNAMED, NEW FOUND OUT & ABERDARE SEAMS

N.S. 183

Analysis etc.	Recovery percent	Section Sampled	Seam Section	Description
				1'0¾" med gy sh
			1164'1¼"	½" inf. coal 3" dk gy. sh.
				3½" carb sh. 1½" inf coal → coal
				3" carb. sh.
				6" coal
				2½" carb. sh. 3" inf. coal
				1¼" carb. sh. 2½" coal ¼" dk gy sh.
				4¾" carb sh w coal lents. 1" coal
				2½" carb sh 1" inf. coal 1½" dk gy sh.
				1" inf. coal 1¼" dk. gy sh 1½" carb sh 1½" coal
				3½" carb. sh. 1" coal 1" carb. sh. ½" inf coal
				3½" carb. sh. 2" inf. coal 1½" carb. sh.
				2½" inf. coal 2¼" carb. sh. 1" coal ¾" inf coal
				1¾" carb sh. ¾" inf. coal 2¾" coal
				4¼" gy sh ¾" carb sh ¾" inf. coal
				3" carb sh 1½" dk gy. sh. 1½" inf. coal
M.% 2·2			1170'3¾"	¼" coal 1¼" carb. sh. 2" coal ½" carb sh.
VM % 22·3				4" inf. coal
F.C. % 36·7				8" coal
A % 38·8	100·0	1632/58		1" dk gy. sh. 1¾" coal 1¾" dk gy sh.
B.T.U./lb. 7890				2¾" carb sh. 2¾" dk. gy. sh. 1½" coal
S. % 0·22				½" carb sh. 1½" inf. coal 1¾" intbd carb. & dk gy sh.
S.G. 1·649			1173'4½"	4½" carb sh. w. coal lenses in top 1½"
				8¼" coal → inf. coal btw. 4¼" & 5½"
M.% 2·1				2¾" inf. coal ½" dk gy. sh. 3¾" inf. coal
VM.% 22·1				½" dk. gy. sh. ¾" coal 2" inf. coal w. ½" band carb. sh.
F.C. % 31·9				½" coal 2" dk gy sh. 1¼" coal 2" inf. coal
A. % 43·9	100·0	1633/58		½" gy sh. 1½" coal ¾" dk gy sh. 2" carb sh.
B.T.U./lb 7140				10½" coal w ½" br. sh. at 1¾"
S. % 0·14				3¾" inf. coal ½" carb. sh
S.G. 1·719				4½" dk gy sh. 1¼" carb. sh.
			1177'4½"	3½" coal w ½" carb. sh. at 1¼" ¾" carb. sh.
				¾" coal 1" dk gy sh
				8½" coal
M % 2·2				¾" inf. coal 3¼" carb. sh w. num. coal lents.
VM % 23·6				3" coal ¾" carb sh. 2" v. inf. coal ½" carb. sh.
F.C. % 36·4				¾" inf. coal ½" carb. sh. 1¼" coal ½" carb. sh.
A. % 37·8	100·0	1634/58		1½" dk gy. sh. ; 2¾" coal 1" carb. sh. 1½" gy sh.
B.T.U./lb. 8060				½" carb. sh. ; ¾" inf. coal 1" gy. sh. ¼" carb. sh.
S % 0·15				1'1¼" coal → inf. coal in places
S G. 1·644				1½" gy. sh. ; ¾" inf. coal ; ½" dk. gy. sh.
				2" coal ; ½" dk. gy. sh. ; 2¾" coal
			1182'4½"	¾" gy. sh. ; ½" dk gy. sh.
M.% 2·2				2'8¼" coal → inf. coal in few places
VM % 28·8				
F.C. % 50·5				
A. % 18·5	100·0	1635/58		½" dk gy. sh.
B.T.U./lb. 11240				5¼" coal ¾" gy. sh.
S % 0·18			1186'0¾"	4" coal, 1" gy. sh.
S G. 1·433				5" coal ½" dk gy. sh.
M.% 2·4				1'3¼" coal w few. sh. lam. btw. 1'0½" & 1'2½"
VM.% 28·9				½" carb sh. 2½" coal
F.C. % 51·4				½" carb. sh.
A. % 17·3	100·0	1636/58		10¼" coal
B.T.U./lb. 11240			1189'0¾"	½" carb. sh. 1" dk gy sh.
S % 0·16				5¼" coal ½" dk gy. sh.
S G. 1·437				10¼" coal → inf. coal in few places
M.% 2·7				½" gy. sh. ; 2¼" coal ½" dk. gy. sh.
VM.% 29·0				2¾" inf. coal
F.C. % 50·1				11¼" coal w. ½" carb. sh. band at 5¾"
A. % 18·2	100·0	1637/58	1191'11½"	6" gy. sh.
B.T.U./lb. 11250				6½" inf. coal
S. % 0·15				1" carb sh. ; 1" coal ; ½" inf. coal ; ½" carb sh.
S.G 1·430				1½" coal ; ½" carb. sh. ; ½" coal
				2¾" dk gy sh ; ½" carb. sh. ; 1¾" inf. coal
				3¼" dk gy. sh. ; ½" carb. sh.
				2" coal ¼" inf. coal ; 1½" inf. coal
				1½" carb. sh. w. num coal lents. ; 1" inf. coal
				½" dk. gy. sh. ; 1" inf. coal
				7¾" gy. sh. 1½" carb. sh. 1¾" inf. coal
				9½" dk. gy. sh.
				4" carb sh. w num. coal lents.
				4" inf. coal 1¾" carb. sh w. num. coal lents.
				1¼" coal 2¼" inf. coal 2½" dk. gy. sh.
				2" inf. coal 3" carb. sh. w. num. coal lenses
				3" dk gy sh. 1½" carb. sh.
				5" inf. coal 2" dk gy. sh. 1¼" inf. coal ½" dk gy. sh.
				3" inf. coal
				9¾" dk gy sh w. coal lenses
				1" carb sh.
				7" inf. coal 1¾" dk gy sh. ½" carb. sh.
				1¾" inf. coal ¾" carb. sh.
				8¾" gy. sh.
				2¾" inf. coal 2¼" gy. sh. ; 1¾" inf. coal
				1" carb. sh. ¾" coal ; 1" carb. sh. 1½" inf. coal
				4½ l. gy. sh. ; ½" gy sh. 1¾" inf. coal
				2½" dk gy sh. 2" inf coal
				7¾" dk gy. sh.
				2" carb. sh. 1¾" dk. gy. sh. 2" carb. sh.
				1" inf. coal 1" l. gy. sh. 3¾" carb sh w. num coal lents
				2¾" inf. coal 1¼" dk gy. sh. 3" carb. sh w. n. coal lents.
				¾" inf. coal
				7½" carb sh. w num coal lents. in top 4"
				2¾" dk gy sh.
				11¾" carb. sh. → dk. gy. sh
			1208'1"	3" coal ; 1" inf. coal ¾" carb sh.
				3" inf. coal ½" dk gy. sh. 1¾" inf. coal
A % 39·2				4½" carb. sh. w num. coal lents.
S.G. 1·664	100·0	1638/58		1'1" inf. coal & coal
				¾" carb sh ; 1¾" coal
				2⅝" dk gy. sh. ; ½" carb. sh. ; 1" inf. coal ; ¾" carb. sh.
				½" coal ; ½" carb. sh. ¾" inf. coal → coal
			1211'8¾"	6" carb. sh. 1" dk gy. sh. ; 2" coal ; 1" carb. sh.
				3½" coal ; ¾" carb. sh. ; 1" dk. gy. sh. ; 1" carb sh.
M % 2·2				1½" inf. coal ; 1½" coal → inf. coal ; ½" carb. sh.
VM.% 29·1				¾" gy. sh. ; ¼" fn. sh.
F.C. % 46·2				4" coal ; 1¼" carb. sh.
A % 22·5	100·0	1639/58		4½" coal w some inf. coal
B.T.U./lb 10650				¾" carb. sh
S % 0·18				2'1¼" coal w. ½" carb. sh. bands at 4¾" & 1'5½".
S.G. 1·466				½" fn. sh. 1½" coal 3¼" carb. sh.
				2½" coal 3½" carb. sh. w. coal lents. → inf. coal
			1216'11½"	2½" coal 1¾" carb. sh. ¾" inf. coal
M.% 2·1				2½" carb. sh. 2¾" coal ; ¾" fn. sh.
VM.% 24·5				1" carb sh. ½" coal ¾" carb sh. ½" inf. coal → cb sh
F.C. % 31·6				½" coal 1½" carb. sh. ¼" dk. gy. sh. 2" coal
A % 41·8	100·0	1640/58		¾" inf. coal ¾" carb. sh. 3" gy. sh.
B.T.U./lb. 7350				3" carb. sh. 1¾" gy. sh. 2½" inf. coal
S % 0·21				6" coal ¾" med. gy. sh. 1¼" coal ; ¼" dk. gy. sh.
S.G. 1·701				2½" l gy. sh.
M % 2·1				1'2½" coal & inf. coal w. ½" sh band at 11"
VM % 24·6			1221'2¾"	¾" carb sh. ; ¾" gy. sh. ; ¼" carb sh. ; ½" gy. sh
F.C. % 30·2				1½" inf coal ; ¼" coal ; ½" gy. sh.
A. % 43·1	100·0	1641/58		3¼" coal ½" carb sh. ; ¼" coal ; ½" l gy sh.
BTU/lb. 6340			1222'0¾"	¼" carb sh. ; ¼" coal
S % 0·17				5¾" inf. coal
S G 1·747				6¾" coal
M % 2·1				¾" carb sh
VM.% 27·7	93·5	1642/58		½" coal
F.C. % 48·6				3¼" carb sh ¼" gy sh. , ½" carb sh
A % 21·6				3½" coal ½" carb sh , ¼" fn. sh ; ¼" carb sh ; ¼" fn. sh.
BTU/lb 10879			1227'7½"	
S % 0·18				2'2½" coal & inf. coal
S G 1·475				
M % 2·4				
VM % 32·1	90·4	1643/58		¼" carb sh. 1½" coal ¼" carb. sh.
F.C. % 58·2				3½" coal
A % 7·3				1'2½" coal & inf. coal
BTU/lb 13150			1229'6"	¾" coal ¾" carb sh 1¾" coal ; ¾" carb sh
S % 0·25				¾" gy sh 2½" carb sh. , ¼" coal ; 3¼" dk gy sh
S.G. 1·333				½" inf. coal ½" dk gy sh , ½" coal ; ¼" dk gy sh
				2" carb sh 3¼" inf. coal ; ¼" carb sh.
			1230'8"	8'9" intbd gy sh & l gy slts.

Overall Recovery 98·9 %

Seam
Unnamed
Seam
New Found Out
Seam
Aberdare

P.D.T.S. No.5 MINE AREA · BOX FLAT

DIAGRAMS OF BLUFF SEAM · DETAILS OF CORE RECOVERY AND ANALYSIS

N.S.168

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				dk. → med. gy sh
			370'7½"	5½"coal ; ½"carb sh.
				3"inf. coal ; ¾"carb sh.
				3½"coal
				7"dk gy sh
				4½"inf. coal w some med gy sh frags
				1½"fn sh. ; 2½"carb sh w coal lents.
				3"bluey → inf. coal 2¾"coal
				1¼"carb sh 3"coal 2¾"carb sh w num coal lts
				4"gy sh. 1¾"coal 2½"gy sh w coal lents.
				4½"coal → inf coal in btm. 1"
				11½"l gy – creamy sh.
			376'1½"	1"carb sh w fn sh lents.
				2"inf. coal → coal ; 1½"carb sh
				1¾"fn sh. ; 2¾"carb sh → bluey
				1½"coal ; ½"fn sh. ; ½"carb. sh.
				10½"coal
				¾"fn sh. 4¼"carb sh.
				1"inf. coal
				7¼"coal
				3½"carb sh w few iron carb nods.
A% 39·2				4¾"coal → inf. coal in btm. ½" 1½"carb sh.
SG. 1·605	99·2	71/58		2"coal → inf. coal
				2¾"carb sh w coal lents. ; 2¼"coal
				¼"carb sh. → bluey ; ¾"coal ; 2¾"carb sh.
				½"fn sh. ; 1"coal 2"carb sh. → bluey
				5½"coal 1¼"coaly sh. ; 1¼"inf. coal
				1¾"carb sh. → bluey
				5¾"coal ½"gy sh.
				3¾"carb sh w num coal lents. ; ½"coal
				3"carb sh. 4¼"inf. coal → coal
				1¾"carb sh.
				4"coal 1¼"gy sh. ; 3"carb sh. → bluey
			384'5¾"	2¾"coal ; 1½"carb sh w coal lents. ; ½"gy sh
				¾"carb sh. 4¾"inf. coal → coal
				3"carb sh w coal lents. 1½"gy sh.
				1¾"bluey 2"coal ; 1½"carb sh & inf. coal
				2"coal 1½"carb sh → bluey ; 1½"coal
				2"med gy sh. 4"coal
				3¼"carb sh. 1½"inf. coal
A% 40·3				3½"coal ½"carb sh. ; ½"med gy sh. ; ¾"carb sh.
SG. 1·675	98·7	72/58		1¼"coal 1½"med – dk gy sh
				7¼"coal w 1"inf. coal at 3½" ; 1"inf. coal
				; dk gy sh ; 2½"coal ; 1½"dk gy. → carb. sh.
				1"coal ; ½"med gy sh
				1⅝"inf. coal ; 2½"coal ; 3¾"inf. coal
				½"med gy sh. ; 2½"inf. coal ¼"carb. sh.
				1¼"med gy sh. ; 1¼"coal 1½"gy sh.
			390'1"	2½"inf. coal & coal 1¼"gy sh.
				10½"coal
				1"dk gy sh. ; 1½"coal ; 1½"dk gy sh.
				1½"inf. coal ; ½"dk gy sh ; ¾"coal
				½"dk gy sh. ; 1¾"coal ; 1½"bluey & inf. coal
				9¾"coal
				1½"coaly sh. ; 1"gy sh ; ¾"carb sh
A% 30·9				5½"coal 1¾"inf. coal 3¾"dk gy sh.
SG 1·594				
WASH AT SG 1·8*	100·0	73/58		5½"coal ½"dk gy sh. ; ¾"inf. coal
Discard % 25·9				
Floats A% 17·9				1'10½"coal → inf. coal in places w. ¼"carb. sh at 4½" & ¼"dk gy sh at 1'0"
				1"dk gy sh ; 1"inf. coal
				5"coal
				6½"inf. coal & coal 1¼"dk gy sh.
				5"inf. coal → bluey ¼"carb sh. ; ¼"med gy sh
			398'5¾" 398'8½"	¼"inf. coal 3¼"carb. sh.
				dk. gy. sh.

Overall Recovery 99·3 %

N.S.172

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				l gy slts.
			302'5½"	6½"l gy sh → creamy sh in sev. places
				8"creamy l. gy. sh.
				6"puggy cream sh → l gy in places
				4"carb. & dk gy sh.
				5"dk gy. sh.
				5"carb & dk gy. sh
				3½"carb. sh. w coal lenses ; 1"coal
				2½"carb. sh. w coal lenses 1½"inf coal
				4"carb sh. 2¾"inf. coal
				2½"coal w. thin carb sh bands ; 1'dk gy sh
				¾"inf. coal, 2½"dk gy sh. w. coal lens
				1"carb sh.
				1'5"dk gy. sh. → carb sh. in places w. few coal lens
				6"coal w ½"carb sh 3½"from top
				¾"carb sh w coal lam ; 1½"inf. coal
				2½"carb sh ; ½"fn sh.
				4¾"coal ; ¼"carb sh. ; ¾"dk gy sh.
				2½"carb. sh. & coal 2½"intbd. coal & carb sh.
				3½"coal 2½"inf coal
				2"carb sh. w. ½"dk gy. sh. ; 1½"carb sh w. coal lam
				3¾"coal 3¼"coal w carb sh lam & few iron carb nods.
				2"carb sh. ; ½"coal 1¾"carb sh w. coal lens
A% 35·1				1½"inf. coal ¾"carb sh. ; ½"coal ; 1¼"inf. coal
SG. 1·681	100·0	74/58		1¼"gy. sh. 4¾"intbd. carb. sh. & coal
WASH. AT SG 1·8*				1½"carb sh. ; 2¾"coal w carb sh lam
Discard % 31·7				1½"intbd. carb sh & coal ; 2½"coal ; 2"dk gy. sh
Floats A% 20·3				1½"carb sh → dk gy. sh ; l dk gy. sh
				1¼"carb sh ; 1¼"dk gy sh ; ¾"carb. sh.
				2¾"coal w. bands of iron carb nods
				¾"carb sh & coal ; ¾"carb sh. ; ½"inf. coal
				2"dk gy & carb sh. ; 1"coal 4¾"dk gy. sh.
				¾"carb sh. ; ¾"coal ¾"carb. sh. ; 1"coal
				¾"carb sh. ; ½"dk gy sh. 1"carb sh.
				2"coal ; 1½"inf. coal ; ½"carb sh w coal lam
				2½"coal w ¾"carb. sh. at ¾" 3½"dk gy. sh.
				1½"carb. sh. ; ¾"inf. coal
				2¾"coal ; 2½"inf. coal ; ¾"dk gy sh
				1¾"coal ; 1¾"carb sh ; 1'dk gy. sh. ¾"carb sh
				4¾"coal w ¾"carb sh at 4" ½"carb sh ; ½"coal
				2"carb. sh. ; ¾"dk gy. sh. ½"fusain
				4"carb. sh. ½"coal ; 2"carb. sh. & coal
				1¾"coal 2¾"dk gy. sh.
				6"coal w. carb. sh. bands at 1¾" & 3½"
				½"gy. sh. arenite ; 1"carb sh ; 1¼"coal ; ¾"carb sh.
				1"dk gy sh ; ¾"carb sh ; ¾"dk gy. sh. ; ¾"inf. coal
				½"dk gy sh. ; 2½"coal ; 1½"coal & carb sh.
				3½"carb sh ; ¾"coal ; 1¾"dk gy. sh.
				4¾"carb. sh. ; ¾"dk gy. sh.
				3¾"coal 2"coal w. carb. sh. bands
				4"dk gy sh ¾"inf coal 3"coal
				¾"inf. coal ; ¾"dk gy. sh. ¾"inf. coal ; ¼"dk gy sh
				¾"coal ; 1"inf. coal 1¼"coal
				3¼"carb sh. ¾"coal ; ½"dk gy sh
				2½"inf coal 1¼"dk gy sh ; 2"carb sh with thin coal bds
			324'2½"	1¾"dk gy sh 2¼"inf. coal , 3"bluey ,
				5½"coal
				1"dk gy sh ; ½"inf. coal ; 1½"coal
				2½"intbd. coal & carb sh.
				6½"coal 2¾"gy sh
				8"inf. coal w ½"dk gy sh at 5½"
				¼"dk gy. sh.
				8½"coal w. ¼"carb sh at 3½" & 5½"
				¼"dk gy. sh. ; 1¾"inf. coal 3¾"coal
				2½"carb. sh. ; ½"coal ; ¼"dk gy. sh. ; ½"coal
				½"dk gy sh. ; 1¾"inf. coal 2"coal
				7¼"inf. coal
				1¾"coal ; 1½"inf. coal 1½"dk gy. sh.
			330'1¾"	3"coal → inf. coal btw. 1¾" & 2½"
				2"carb. sh. ; ¾"dk gy sh ; 1¼"v. inf. coal
			330'10½"	3¾"carb sh ; 1½"coal
				dk gy. sh.

Overall Recovery 99·6 %

N.S.176

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				1'3"faulted, slick. & brecc. d gy. sh.
			501'0½"	6"inf. coal, slightly slick.
				3"coal, slightly slick.
				4½"carb sh. w. num coal lam.
				3¼"carb. sh. w. ½"fn sh. lens at 2" ½"coal
A% 29·6				1'5½"coal w. ½"fn. sh. at 1'1" & iron carb nods in btm. 1½"
SG. 1·579	95·8	74/58		¾"fn. sh. arenite
WASH AT SG 1·8*				1'6¾"coal w few iron carb nods in top ½" btw. 10½"-10" and w ½"carb. sh at 8½"
Discard % 22·5				2"gy sh.
Floats A% 17·5				8"coal ½"carb sh 3¾"coal
			507'0"	3¼"gy. sh 1¼"coal ; ½"gy. sh. ¾"coal ; ¾"carb sh.
				4½"coal w carb sh lam., iron carb. & cal. lacings
				11"l gy. sh. → creamy sh. at 8"-9½"
				3¼"carb sh.
			503'1"	5"coal w. ½"dk gy. sh. at 1" 1¼"fn sh.
				6½"coal w. ¾"bluey at 4½"
				1½"inf. coal ¾"gy. sh. ; ½"carb. sh. → inf. coal
				8½"coal
				5¾"carb. sh. w. num. coal lents. in top 2"
				2¾"coal ; ¾"fn. sh. 3"coal w thin carb. sh bds.
				1¼"carb. sh ; 1¼"coal ¼"fl. sh. 2"coal → inf. coal
A% 31·5				6¾"coal w. ½"carb sh at ½" & 4½"
SG. 1·587	99·3	76/58		½"fn sh ; ½"carb sh. ; ¼"fn. sh. ; 1"carb sh.
WASH. AT SG 1·8*				9¾"coal
Discard % 25·6				5½"carb. sh w num. coal lam. → inf. coal at 2¾"-3"
Floats A% 18·6				6¾"coal ¾"gy sh.
				¾"inf. coal w ½"carb sh at 2"
				2¾"coal w ¾"carb sh at 1" ½"bluey
				9"coal
				1"fn sh.
			516'11"	6½"coal
				½"l gy. sh. ; 1¼"coal ; ¾"l gy. sh.
				2½"inf coal 2½"coal ; 1¾"dk gy. sh. ; ½"inf. coal
				6¾"coal w few sh. lents at 2¾"
				3"inf. coal w sh lents. & few iron carb nods in top 1½"
				3½"coal 1½"dk gy sh
A% 35·8				3¼"coal 1¼"bluey 2½"coal ; ¾"carb sh.
SG. 1·647	97·8	77/58		3½"coal ½"dk gy sh
WASH. AT SG 1·8*				10"coal
Discard % 35·8				½"dk gy. sh. ; 2½"coal ; ½"dk gy. sh.
Floats A% 17·6				3½"inf. coal w. med. gy. sh. lens at ½"
				4½"coal ½"carb. sh. ; 1"dk gy. sh.
				10"coal → inf. coal at 4"-5½"
				½"dk gy sh ; 1"coal 2½"gy. sh.
			523'5¾"	3½"coal w cal. lacing & some iron carb nods
				1"carb. sh. ; 1"dk gy sh ; 1"inf. coal
				2"coal ; 1"carb. sh.
				8½"coal
				¾"dk gy. sh. ; 2¾"coal w. cal. lacings
				1¾"dk gy. sh. ; 1¾"coal w. sh. lents. ; ½"dk gy sh
				2"bluey ; 1½"coal ; 1½"bluey
				11½"coal
				1½"carb. sh. ; 1¾"inf. coal
				1¾"coal & carb. sh 70-30
				2"coal 2"gy. sh.
A% 26·9				8¾"coal → inf. coal at 3"w cal. lacings in btm. 2¾"
SG. 1·553	98·6	78/58		¾"dk gy sh. ; ¾"carb sh ; ½"dk gy sh
WASH. AT SG 1·8*				1'6¾"coal w sh. lam. at 1½", 9" & 10½"
Discard % 22·4				1½"inf. coal 3"coal
Floats A% 15·8				2¾"coal ; ½"carb sh 2"inf. coal ; ½"dk gy. sh.
				11½"coal → inf. coal in places
				¾"dk gy. sh.
				6½"coal
			532'5¾"	1"dk gy sh 2¾"coal ; ½"dk gy. sh.
				¾"coaly sh. ¾"carb. sh. w gy sh & coal lam
				¾"inf. coal → coal ½"dk gy sh. ; ¾"coal
				2"br. sh ; 2"inf. coal 1¾"dk gy sh.
				2¾"coal w. sh. lents. ½"dk gy sh. ; ¾"coal
			534'4"	dk gy. sh.

Overall Recovery 98·3 %

* See Table I for details of washability tests and analyses

P.D.T.S. No.5 MINE AREA · BOX FLAT

DIAGRAMS OF BLUFF SEAM · DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 177

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				med gy slts & sh
				7½" med gy sh
				403'2½" 4"dk gy sh ; 2"carb sh ; 1½" fn sh ; 1"carb sh
				403'7" 1½" coal ; 1"carb sh ; 2" gy sh
				½" inf coal ; 1" dk gy sh
A% 46·2 SG. 1·838	100·0	803/58		8¾" coal w ¼" dk gy sh at ¾" & 5¾" and w ½" inf coal at 6¾"
				¾" dk gy sh ; ½" carb sh ; 1½" coal ; 1"dk gy sh
				6½" coal ; ½" carb sh
				3" coal w ½" carb sh at 1¾"
				½" carb sh ; ½" coal ; ¼" med gy sh ; ½" coal
				¼" gy sh ; ¼" med gy sh ; ½" carb sh
				4½" coal ; ½" carb sh
				1½" coal w ½" gy sh at 1" ; ½" fn sh
				407'11½" ½" coal ; 1" dk gy sh ; ½" inf coal
				½" carb sh ; ½" coal ; ¼" gy sh ; ½" inf coal
				½" inf bd dk gy sh ; ½" coal ; ½" dk gy sh
				½" coal ; ½" carb sh ; ½" gy sh ; ½" coal
				½" gy sh ; ½" inf coal ; ½" carb sh ; 1" coal
				½" carb sh ; ½" coal ; ¼" gy sh ; 1" coal
				½" cr sh w lam gy sh lam
				10" cr slts
				411'2½" 1" carb sh ; 1½" inf coal w few iron carb nods
				1" coal bd ; ½" gy sh ; ¾" carb sh
				2" inf coal - coal 1½" fn sh
				½" inf coal ; 1" carb sh ; ½" coal
A% 59·1 SG 1·878	97·4	810/58		½" carb sh w coal lenses ; 1" inf coal
				½" coal 3½" inf coal, coal & carb sh
				½" gy sh ; 1½" inf coal ; ½" gy sh
				¼" coal ; ½" carb sh ; 1½" carb sh
				414'5½" 2" coal ; ½" carb sh ; 1½" inf coal
				5" carb sh
				1" coal w ½" fn sh at 2"
				¾" carb sh ; ½" fn sh ; 1" carb sh
				1" inf coal ; 2¾" coal ; 1" carb sh
				2" coal 2½" carb sh ; 1" coal ; 1" carb sh
A% 30·5 SG 1·625 WASH AT SG 1·8*	100·0	811/58		3½" coal ; 1" gy sh ; ½" carb sh
				¾" inf coal ; ½" carb sh ; ½" coal
Discard % 21·6 Floats A% 21·2				2" coal ; ½" carb sh ; 1" inf coal ; ¾" coal
				½" carb sh w coal lenses ; ¾" coal
				413'1½" ½" dk gy sh ; ½" gy sh ; 1½" coal ; ¼" gy sh
				½" coal ; ½" carb sh ; 2¼" coal
				½" dk gy sh ; ½" coal ; ½" gy sh ; 1½" carb sh
				1" coal 2" inf coal & ¾" int bd coal & inf coal
				1½" dk gy sh ; 1" coal ; ¼" carb sh
				½" inf coal ; 1" dk gy sh ; ½" coal
A% 44·0 SG. 1·805 WASH AT SG 1·8*	98·6	812/58		1½" carb sh ; ¼" coal ; ½" gy sh
				½" coal ; ½" dk gy sh
Discard % 39·5 Floats A% 21·6				4" coal
				4½" carb sh w coal frins ; w. ½" fn sh at ½"
				1" coal ; ½" gy sh ; 1" carb sh ; ½" med gy sh
				3½" inf coal ; 1½" coal ; ½" gy sh
				2½" inf coal 3¾" dk gy sh.
				424'10" 5⅝" coal
				½" gy sh ; 1" carb sh. ; ⅝" coal ; ½" carb sh.
				2⅝" coal 2" carb sh ; ½" dk gy sh ; 1" coal
				⅝" dk gy sh. ; ½" carb sh ; 1" coal
				½" carb sh ; ½" dk gy sh
				7⅛" carb sh w coal lenses
A% 31·8 SG 1·660 WASH AT SG 1·8*	97·0	813/58		4½" coal 2½" carb sh w coal lenses
				1" inf coal ; ½" coal ; ½" carb sh
Discard % 30·4 Floats A% 18·4				1" coal , 1½" carb sh ; 1" dk gy sh
				1'8½" coal w ¾" inf coal at 5½"
				" dk gy sh at 1'1½" & 1'4"
				½" inf coal , 2" carb sh ; 1½" inf coal
				1" coal , ½" carb sh ; ½" gy sh
				1½" coal , ½" carb sh ; 1" gy sh
				1½" inf coal - coal
				431'0½" 4" coal 1½" carb sh ; ½" dk gy sh ; 1½" coal
				432'6" 4" carb sh w coal lenses in top 2"
				8" gy slts
				gy sh

Overall Recovery 98·2 %

N.S. 181

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				4" gy sh.
				9½" dk gy sh
				503'2½" 5½" coal w ½" fn sh.
				1½" fn sh
				1'0" coal - inf coal in btm. 1"
				½" cream sh 2½" carb sh
				1⅛" coal ⅛" gy sh
				2½" coal & inf coal
				⅝" dk gy sh.
				10½" coal
A% 38·2 SG 1·654 WASH AT SG 1·8*	79·7	814/58		2" gy sh ; ½" coal ; 1" fn sh
Discard % 38·3 Floats A% 16·7				7½" coal
				1½" inf coal ; ½" carb sh ; 1" dk gy sh
				6" coal
				1½" gy sh , ½" inf coal , ½" carb sh
				10½" coal - inf in places w ½" gy sh
				524'4" 8" dk gy sh w ½" coal at 2½"
				3½" coal w num gy sh ½ bds ; 1½" gy sh
				3¾" coal w ½" gy sh at 1½" ; 2½" gy sh
				1'3¾" cream sh
				525'3½" 1½" carb sh ; 2½" crumbly coal w num shaly bds
				½" carb sh ; 1½" gy sh ; ½" blury ; ½" inf coal
				1'1½" coal w some inf coal in top 4"
				3" bluey
				8" coal w some inf coal
				1½" gy sh ; 2" coal
				3½" carb sh w coal lents. 1½" inf coal
				4" dk gy sh
A% 40·0 SG 1·640 WASH AT SG 1·8*	94·7	815/58		2½" carb sh w num coal lents 1" gy sh
Discard % 36·8 Floats A% 20·5				10⅝" coal - inf coal at 3½" &
				2'2" gy sh ; 1" sh ; carb sh & coal ½" inf coal
				½" dk gy sh ; 1½" bluey
				2'8½" coal w 1" bluey at 6½" & ½" gy sh at 1'1"
				523'10½" 1" gy sh. 3" inf coal - coal
				6" coal
				35" gy sh w ¼" coal at 2"
				2'0" coal - int btw 3½" & 5"
A% 43·9 SG 1·792 WASH AT SG 1·8*	90·0	816/58		1½" gy sh , 1" inf coal
Discard % 41·3 Floats A% 18·5				1½" coal
				1½" bluey 4" carb sh
				2" int. coal , 2" coal 1⅝" carb. sh. w coal lens.
				4" dk gy. sh.
				10" coal
				530'5⅛" 2½" dk gy. sh.
				11" coal
				1" bluey 4" coal 1½" inf. coal
A% 38·5 SG 1·745 WASH AT SG 1·8*	97·2	817/58		3" coal 1½" bluey 4½" coal
Discard % 27·8 Floats A% 17·7				4½" gy sh
				5" coal w some inf coal 1½" gy sh
				1" coal 1½" inf coal
				4½" coal w ¼" carb sh at ¾" ; ¾" carb sh
				5½" coal w ¼" carb sh at 3½"
				1½" inf coal
				8" coal
				3½" boulder
				4" coal ½" dk gy sh ½" carb sh.
				3'0" coal w inf coal & some carb sh
A% 29·1 SG. 1·533 WASH AT SG 1·8*	81·2	818/58		1½" carb sh.
Discard % 26·5 Floats A% 17·0				10" coal
				2½" inf coal
				3½" coal
				3" coal & inf. coal
				4½" inf. coal - carb sh. w. coal lents.
				543'5" dk gy. sh.

Overall Recovery 90·4 %

N.S.182A

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				dk gy. sh.
				630'5½" 5½" dk gy sl. carb. sh.
				3¾" coal w some carb. sh.
				5" coal & inf. coal
				1" inf. coal ; 2" coal ¼" carb. sh. ; ½" coal
				3⅝" carb. sh.
				2½" inf. coal - coal in places
				8½" coal w three ¼" bds carb sh
				1½" int. bd coal & carb sh
A% 30·1 SG 1·697 WASH AT SG 1·8*	79·5	819/58		6½" coal w ¼" gy st at 3½"
Discard % 24·2 Floats A% 16·8				4" coal w some carb sh & fn sh
				¼" carb sh ; ½" fn sh ½" carb sh
				4½" coal w some inf coal
				½" dk gy sh ; 1½" carb sh
				1½ crumbly coal ¼" inf coal ¼" coal
				636'4½" 1½" coal & carb sh. 1½" gy sh
				1" carb sh , ¾" fn sh , ½" coal 1½" carb & dk gy sh.
				7" fn sh 1¼" cream sh 1½" fn sh
				637'8" 8" carb sh w coal lents & inf coal
				3½" coal
A% 45·6 SG 1·701	72·6	820/58		10" bluey, coal & some carb sh
				2" dk gy sh 4½" carb sh w ¼" fn sh lens at 3"
				640'10½" 1½" coal 1" inf. coal
				4½" coal w some carb sh
				1" fn sh ¼" carb sh ; ½" coal
				2½" carb sh w coal lents. ¾" coal ; ¾" carb sh
				2½" coal ½" carb sh ; ¾" dk gy sh ; ½" carb sh
				¾" dk gy sh ; ½" coal
				½" coal, inf coal & carb sh. ; 1" coal
				¼" carb sh.
A% 35·1 SG 1·590 WASH AT SG 1·8*	75·2	821/58		9½" coal w some carb sh
				¼" dk gy sh , ¾" carb sh 2" coal
Discard % 26·2 Floats A% 17·0				5⅜" coal w some inf coal & carb sh
				4½" coal ¾" inf coal ; ½" coal 1" dk gy sh
				4 carb sh w some coal
				3½" coal ½" carb sh
				2·2" coal ⅜" inf. coal
				11" coal w. carb. sh. btw 5" & 11"
				648'4½" 2" carb. sh. w. coal lents. ½" dk gy sh.
				2½" coal & inf coal ½" bluey ; 1" coal
				½" dk gy sh. 3¾" coal & carb sh
A% 27·0 SG 1·723 WASH AT SG 1·8*	100·0	822/58		1¼" coal ½" inf coal & coal ; ½" coal ; ½" dk gy sh
				1½" coal ½" dk gy sh ; ½" coal ; ½" gy sh
Discard % 26·9 Floats A% 13·8				1¼" inf. coal w. ¾" gy sh at ½"
				6½" coal - inf coal at ¼" - 1½"
				2" carb sh ; ½" dk gy sh
				1'1¼" coal w some inf coal & carb sh.
				¾" gy sh ; ¾" coal
				4" inf. coal 3" coal ; 1" bluey ; 1" carb sh.
				3½" coal ⅜" inf. coal 3½" coal
				653'11⅜" 1½" inf. coal - coal ; 1" dk gy. sh
				4" coal 1½" inf. coal
				10½" coal
A% 28·2 SG 1·651 WASH AT SG 1·8*	100·0	823/58		1½" int. bd. carb sh., coal & dk gy sh. ; 1" dk gy sh
				1½" carb. sh. ; ½" coal ; ½" carb. sh.
Discard % 28·0 Floats A% 13·9				2" carb. sh. & coal ; 2" coal ; ¾" dk gy. sh.
				3¾" inf. coal 1½" dk gy. sh. ; 1½" gy. sh.
				8½" coal w. bluey bands
				4" dk. gy sh ; ½" carb sh
				5½" coal w some inf coal
				5" carb sh & inf. coal
				4" coal & inf coal
				5" carb sh w. some inf. coal
				3½" coal , ¾" inf. coal ½" dk gy sh
				4" inf coal
				10 ¾" coal - inf in places
				660'10" ½" carb sh. ; 1½" dk gy sh.
				3" carb. sh. ; 1½" inf. coal
A% 50·5 SG. 1·914	100·0	824/58		4½" int. bd. carb sh , coal & dk gy sh.
				3½" carb sh.
				3½" dk gy sh
				6½" coal & inf. coal
				664'1½" ½" gy. sh. ; 1" inf. coal - coal ; 1⅜" coal
				½" dk gy sh ; 1" inf. coal w some carb sh
				1" gy. sh. ; 2¾" coal ; ½" gy. sh. ; 1¼" coal
				664'4½" ½" dk gy sh ; ½" coal ; ½" dk. gy sh ; 2¼" carb sh
				8¼" int. bd. dk gy. sh., carb sh. & coal
				dk gy sh.

Overall Recovery 81·8 %

N.S.183

Analysis etc.	Recovery per cent	Section Sampled	Seam Section	Description
				int. bd 1 gy. slts. & gy sh
				11" dk gy sh
				1324'6½" 3½" coal ; ½" dk gy. sh. ; 1⅛" 1 gy. sh. ; ½" carb sh.
				2½" coal 2½" inf. coal & carb. sh.
				3" coal 3⅝" carb sh. w. coal lents.
				¾" gy. sh. ; ½" carb sh. ; ¾" gy. sh. ; ½" carb sh
				1⅛" inf. coal ; ½" carb sh. ; 3" coal
				½" carb sh ; ½" gy sh ; ¼" coal
				4" coal & inf. coal ; ¼" coal ; 14" inf coal
				1½" carb sh. ; ½" inf. coal
				½" coal w coal lents. ; 1½" coal
				½" carb sh. ; ½" coal ; ½" gy sh ; ½" inf coal
				1½" dk gy sh ; ½" inf. coal ; ½" coal
				4" coal
				6½" carb sh w coal lents. w. ½" coal bands
				1'6" 3½" & 4½"
				9½" coal - inf coal in btm ¾"
A% 30·8 SG. 1·560 WASH AT SG 1·8*	100·0	994/58		1330'4½" ½" gy. sh. ; ½" inf. coal ; 2" ½" gy. sh.
				1330'6" ¼" carb sh ; 1" inf coal ; 1" carb sh
Discard % 26·9 Floats A% 15·0				½" coal ; ½" gy. sh. ; 1" carb. sh.
				14" coal ; ½" carb sh ; ½" inf coal
				6½" carb sh w coal lents.
				3½" gy sh
				2½" carb sh w coal lents.
A% 48·3 SG 1·724	88·9	905/58		1" dk gy sh ; ½" coal ; ½" dk gy sh ; ½" gy sh
				1332'10½" 1½" coal - inf coal ; 1" gy sh
				2" carb sh w coal lents.
				1'10 ¾" 1 gy sh. - slts in places
				1334'9½" ½" carb sh 2" 1 gy sh
				5" carb sh - inf coal at 2"- 4"
				1½" coal , 1" carb sh 1" dk gy sh
A% 57·2 SG 1·860	97·8	996/58		9½" carb sh
				5½" inf. coal 1" 1 gy sh
				4" carb sh w coal lents 3" dk gy sh
				1338'3" 3½" carb sh w coal lents
				5" coal
				3¼" carb sh ; ½" dk gy sh in places
				3½" coal w ¼" sh bind at 1"
				3½" carb. sh 4" inf. coal
				3½" coal ½" dk gy sh ½" inf coal
A% 30·7 SG. 1·556 WASH AT SG 1·8*	95·0	997/58		1" carb sh ; ½" gy sh ; 1" carb sh
				¾" coal ; ½" carb sh 5" coal
Discard % 28·6 Floats A% 17·1				1½" carb sh ; ½" 1 gy sh ; ½" dk gy sh
				1½" 1 gy sh ; 1" inf. coal ; 14" coal ; 1" boulder
				9" coal w ½" carb sh at 4" & 5½"
				1" dk gy sh ½" coal ; 1" carb sh
				1343'4" 1½" coal & inf. coal w ½" carb sh at ¾"
				1" dk gy sh 5" carb sh w. coal lens
				½" dk gy sh ; ½" carb sh ; ½" dk gy sh.
				1½" coal ; ½" coal ; 2½" coal ; 2¼" carb sh
				14" coal ; ½" carb sh ; ½" carb sh
				1½" coal , 1" dk gy sh. ½" bluey
				6" coal
				1½" carb sh ; ½" coal 1" carb sh , 1½" coal
				½" dk gy sh 1¼" carb sh ; 1¼" dk gy sh
				2" coal ; ½" carb sh ½" coal
				1" dk gy. sh. ; coal ; ½" carb sh ; 1" coal
				1" carb sh ; ½" dk gy sh. ; ½" carb sh
				4½" gy sh ; ½" coal ; ½" carb sh w coal lents.
				14" coal ; 1½" inf coal ; 1½" dk gy sh
				1½" inf coal ½" carb sh
				6½" inf coal & coal
				½" coal ; 2" dk gy sh. 4½" coal
				2½" carb sh ; ½" coal ½" carb sh ; ½" coal
				1½" carb sh - dk gy sh in places ; 1" carb sh
				1350'0" 2" inf. coal
				10½" coal
				½" carb sh
				7½" coal
				3½" inf. coal
				2" coal 1" inf coal , ½" carb sh ; 1" dk gy sh
				½" carb sh 2½" coal , 3½" inf. coal & coal
				¾" carb sh ; ½" inf. coal , 2½" gy sh
				3½" inf coal 2½" carb sh w coal lents
				¾" gy sh 1¾" carb sh ; 1¼" inf coal
				3½" coal 3½" inf coal 1½" coal
				2½" carb sh
				9" coal ¾" inf. coal 1½" gy sh
				3½" inf coal
				1'1" coal - inf. coal in btm. 5"
				½" carb sh. ; 1½" dk gy sh. ; ½" carb sh
				5⅝" coal
				½" inf coal ; 1" inf coal - coal
				3½" carb sh 2½" dk gy sh 4 ¾" carb sh
				5" coal ½" dk gy sh
				3½" coal 2⅜" inf. coal
				⅜" carb sh ; 1" coal
				1361'4" ½" inf coal ½" carb sh. ; ½" inf coal ; ½" carb sh
				½" coal
				9⅜" int. bd. carb. & dk gy sh.
				1362'3" 1½" inf. coal
				1 gy sh. - slts in places

Overall Recovery 96·0 %

* See Table 1 for details of washability tests and analyses

P.D.T.S. No.5 MINE AREA · BOX FLAT
DIAGRAMS OF WRIGHT AND LAGOON SEAMS
DETAILS OF CORE RECOVERY AND ANALYSIS

WRIGHT SEAM

N.S.178

Analysis etc.	Recovery percent	Section Sampled	Seam Section	Description
A% 33·6 SG 1·595 WASH AT SG 1·8* Discard % 29·9 Floats A.% 18·3	92·1	1000/58	926'7¾"	1'10" dk gy sh 10" carb sh 8¾" dk gy sh 2½" carb.sh. w. coal lens in btm 1½" 1¾" dk. gy. sh ; 1" carb. sh.
			928'9¾"	5¾" coal w ½" carb sh at 1¾" and 4½" ½" br.sh ; 2" inf coal ; 1" coal 1" carb sh 2¼" inf. coal ½" carb sh. 7" inf. coal 1½" coal ; 1" dk gy sh. ; 1½" coal 1¼" carb.sh. ; ¾" dk gy sh ; 1¼" carb.sh. → inf coal 1½" coal 3¼" carb sh w ½" coal at 1¾" ; ¾" coal ½" carb sh. ; 1" inf coal 3½" coal 2¾" inf. coal 1½" gy sh. ; ½" inf. coal 2¾" carb. sh. → inf coal btw 1½" & 2¾" ¾" fn sh ¾" coal ; ¾" fn sh ; 1½" carb sh. ¾" coal ; 1½" carb sh w fn sh lens in top ¾" 2" coal ; ½" carb sh w 2 fn sh lens up to ½" & ¼" coal at 1¼" & 2¾" 8" coal w ½" carb sh at 2" & 3¼" and w. ¼" carb sh at 7" 1½" inf coal 1½" inf coal → coal ; ½" gy. sh. 1¾" inf coal ¼" gy sh ; 1" carb sh w ¼" gy. sh. at ½" 2½" coal ½" gy. sh 6¼" coal w some inf. coal ½" carb sh. 3" coal ½" gy sh.
			931'4"	5" coal, inf. in top 1" 1¼" fn sh ; 1¼" inf coal 2½" fn sh. ; ½" carb.sh. ; 1½" inf. coal ; 1¼" coal " dk gy. sh. 3¾" fn sh.
			933'10½"	1½" carb sh. 2¼" coal 3½" boulder 2¼" coal 1½" inf coal 5½" carb sh w. ½" coal at btm 1" fn sh w coal lens in middle 2¾" coal 2¾" inf. coal ; 1½" coal ¼" gy sh ; 1½" carb sh 2" coal → inf coal at btm 2¼" carb sh. 2" coal 3½" carb sh. w fn sh, part near top & ¾" inf. coal at " " " " " " " sh. " " " " " " " sh. 2½" inf. coal ½" dk gy sh. 3¾" coal 2" coal → inf coal w ¼" carb sh at 1" 1¼" carb sh. 1" coal ¾" carb sh 1¼" coal ½" carb sh ; ¾" coal ; 2¾" carb. sh. 10½" coal ½" carb sh ; 1" dk gy sh ; 1¾" intbd coal & dk gy sh. 9½" coal 1¾" dk gy. sh. 6" coal
			944'6"	1¾" intbd. dk gy. & carb. sh. 1¼" inf. coal ; 1" carb sh ; 1" dk gy sh ; 1" carb sh ¾" coal ; ¾" dk gy sh ¾" carb sh 1" coal ; ¾" carb sh ½" coal ; 1" carb sh. 1½" inf. coal ; ¼" coal ; 2¾" carb. sh. 8½" dk gy. sh.
			948'10"	

Overall Recovery 96·3%

N.S.183

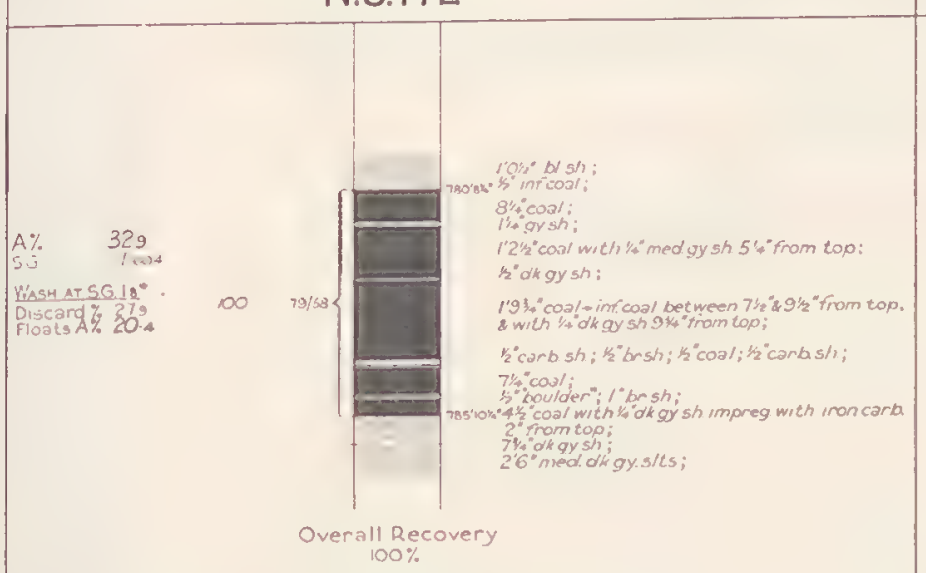
Analysis etc.	Recovery percent	Section Sampled	Seam Section	Description
			1483'8"	4½" gy sh 3" ¼" carb sh ½" " " " " " " 1½" inf. coal 11½" coal → inf. coal in places ¾" carb sh 1'4½" coal ¾" inf. coal → coal 2½" dk gy sh. 1'6½" coal w ½" carb sh band at 1'3½" 1" carb sh ; 1" inf. coal ; ¾" gy sh. 4½" coal → inf. coal at btm. ¼" dk gy sh 2½" coal → inf coal ½" carb sh 2½" coal ; 1½" inf. coal 7" coal 7" l.gy.sh 3½" coal ; ¾" l gy sh 1¼" coal → inf. coal ; ¾" dk gy. sh ; 1¼" inf. coal ¾" carb.sh. ; 1¼" coal ½" inf. coal ; ½" l gy sh. 3½" coal 2" carb sh. w. l.gy.sh. lenses 5" coal 1½" inf. coal ; 1½" bluey. 4⅜" coal 7¾" carb sh. 9⅜" coal w ¼" fn sh at 2", 6" & 8¼" ¼" fn sh 1'1½" coal
			1488'4"	¼" gy. sh ; 1¼" coal ; 1½" l gy. sh ; ½" carb sh " coal ; ¾" l gy sh ; 1¼" coal ; 1¾" l gy. sh " " " " " " "

FIG. 8

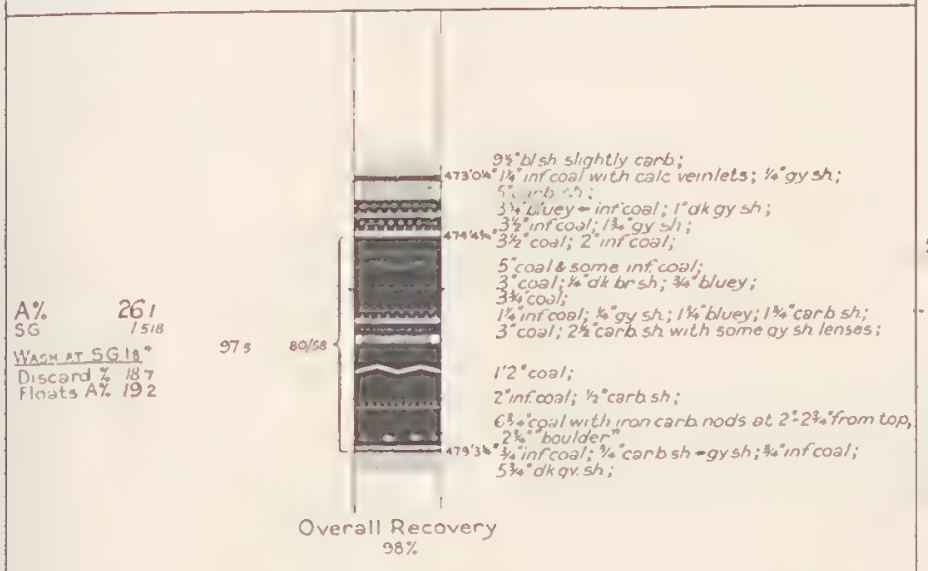
P.D.T.S. No. 5 MINE AREA • BOX FLAT
DIAGRAMS OF ROB ROY AND FOUR FEET SEAMS
DETAILS OF CORE RECOVERY AND ANALYSIS

ROB ROY SEAM

N.S.172

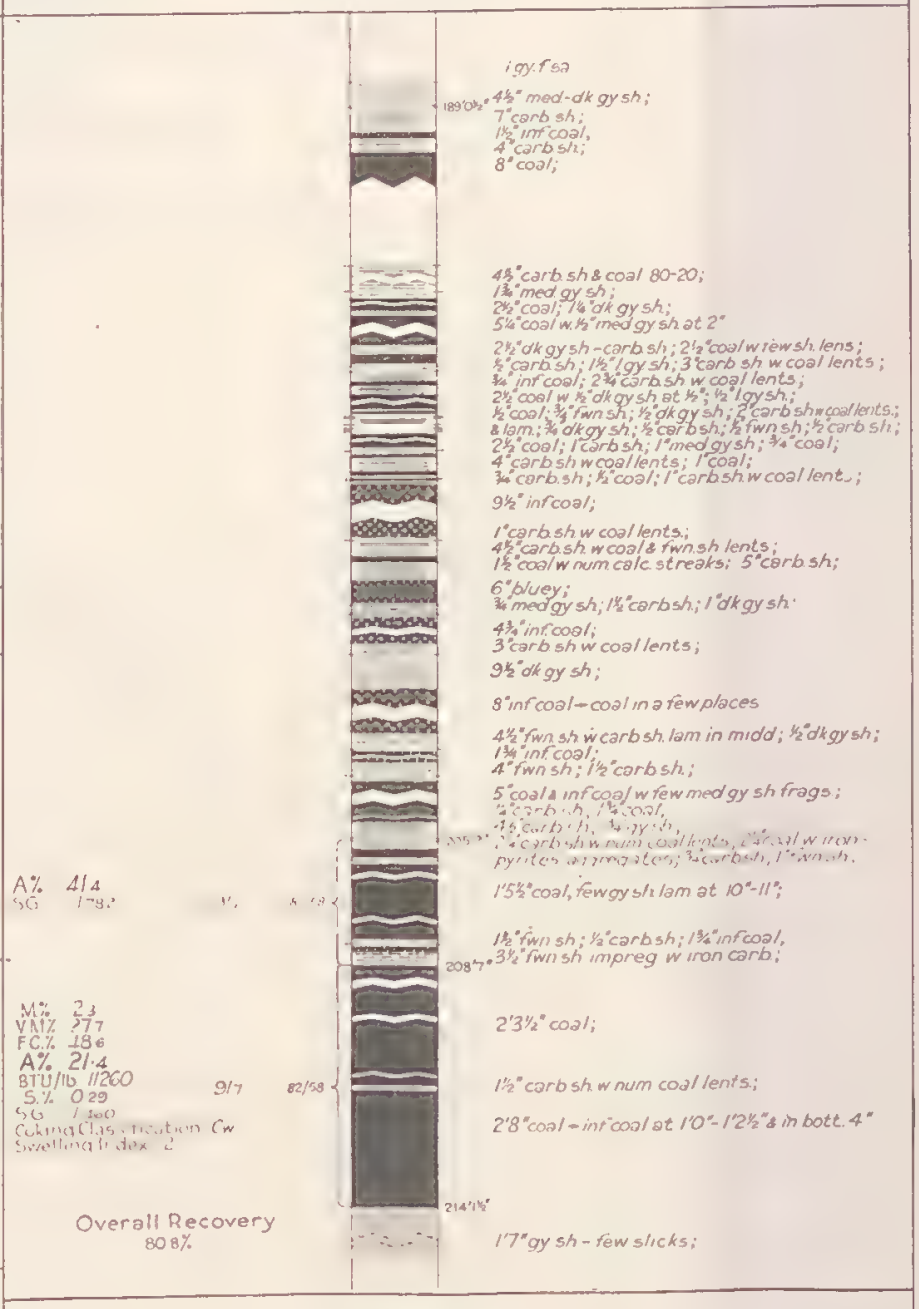

Analysis etc
Recovery percent
Section Sampled
Seam Section
Description
A% 32·9
S.G 1·604
Wash at S.G. 1·8*
Discard % 27·9
Floats A% 20·4
100
79/58
1'0½" bl sh;
780'8¼" ½" inf coal;
8¼" coal;
1¼" gy sh;
1'2½" coal with ¼" med gy sh 5¼" from top;
½" dk gy sh;
1'9¾" coal - inf coal between 7½" & 9½" from top, & with ¼" dk gy sh 9¾" from top;
½" carb sh; ½" br sh; ½" coal; ½" carb sh;
7¼" coal;
½" boulder"; 1" br sh;
785'10¼" 4½" coal with ¼" dk gy sh impreg with iron carb. 2" from top;
7¼" dk gy sh;
2'6" med. dk gy. slts;
Overall Recovery
100%

N.S.174

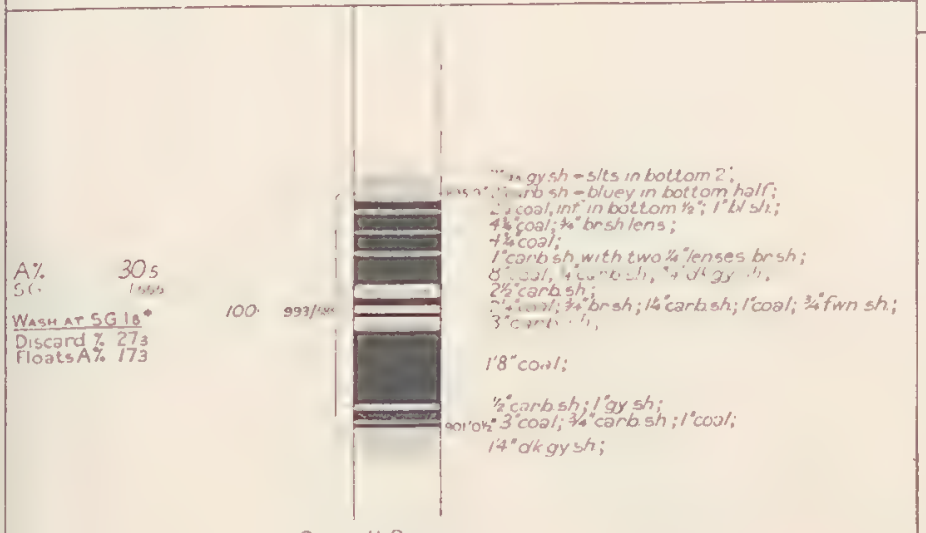

9½" bl sh slightly carb;
473'0¼" 1¼" inf coal with calc veinlets; ¼" gy sh;
5" carb sh;
3¼" bluey - inf coal; 1" dk gy sh;
474'4¾" 3½" inf coal; 1¾" gy sh;
3½" coal; 2" inf coal;
5" coal & some inf coal;
3" coal; ¼" dk br sh; ¾" bluey;
3¾" coal;
1¼" inf coal; ¾" gy sh; 1¼" bluey; 1¾" carb sh;
3" coal; 2½" carb sh with some gy sh lenses;
A% 26·1
SG 1·518
Wash at S.G 1·8*
Discard % 18·7
Floats A% 19·2
97·5
80/58
1'2" coal;
2" inf coal; ½" carb sh;
6¾" coal with iron carb nods at 2"-2¾" from top,
2¾" "boulder"
479'3¾" ¾" inf coal; ¼" carb sh - gy sh; ¾" inf coal;
5¾" dk gy sh;
Overall Recovery
98%

FOUR FEET SEAM

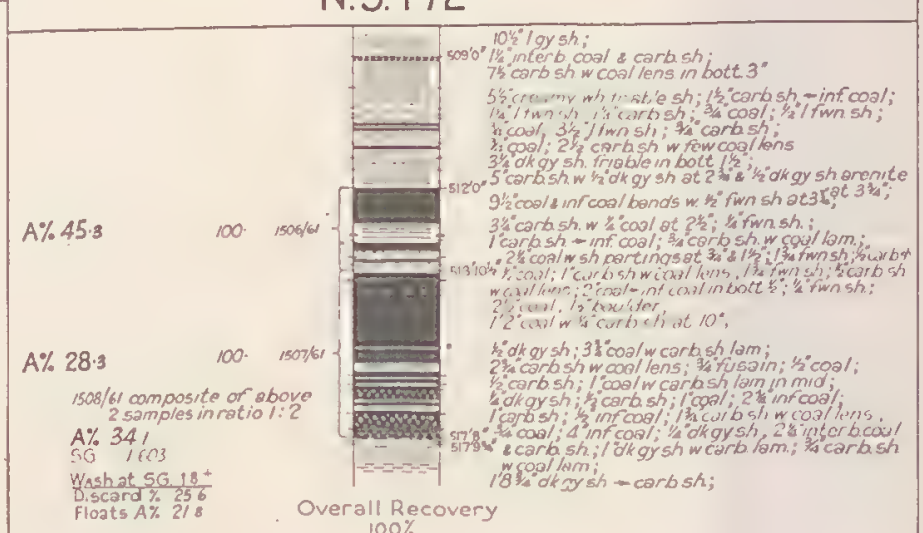
N.S.174


Analysis etc
Recovery percent
Section Sampled
Seam Section
Description
A% 41·4
S.G 1·782
M% 2·3
V.M.% 27·7
F.C.% 18·6
A% 21·4
BTU/lb 11260
S.% 0·29
S.G 1·460
Coking Classification Cw
Swelling Index 2
9·7
82/58
i gy. f sa
189'0½" 4½" med-dk gy sh;
7" carb sh;
1½" inf coal,
4" carb sh;
8" coal;
4½" carb sh & coal 80-20;
1¾" med gy sh;
2½" coal; ¼" dk gy sh;
5¼" coal w ½" med gy sh at 2"
2½" dk gy sh - carb sh; 2½" coal w few sh lens;
½" carb sh; 1½" l gy sh; 3" carb sh w coal lents;
¾" inf coal; 2¾" carb sh w coal lents;
2½" coal w ½" dk gy sh at ½"; ½" l gy sh.;
½" coal; ¾" f wn sh; ½" dk gy sh; 2" carb sh w coal lents. & lam; ¾" dk gy sh; ½" carb sh; ½" f wn sh; ½" carb sh;
2½" coal; 1" carb sh; 1" med gy sh; ¾" coal;
4" carb sh w coal lents; 1" coal;
¾" carb sh; ½" coal; 1" carb sh w coal lents;
9½" inf coal;
1" carb sh w coal lents.;
4½" carb sh w coal & f wn sh lents;
1½" coal w num calc. streaks; 5" carb sh;
6" bluey;
¾" med gy sh; 1½" carb sh; 1" dk gy sh;
4¾" inf coal;
3" carb sh w coal lents;
9½" dk gy sh;
8" inf coal - coal in a few places
4½" f wn sh w carb sh lam in midd; ½" dk gy sh;
1¾" inf coal;
4" f wn sh; 1½" carb sh;
5" coal & inf coal w few med gy sh frags;
¼" carb sh, 1¾" coal,
4½" carb sh, ¾" gy sh,
205'2" 1" carb sh w num coal lents, 2" coal w iron pyrites ammonites; ¾" carb sh, 1" wn sh.
1'5½" coal, few gy sh lam at 10"-11";
1½" f wn sh; ½" carb sh; 1¾" inf coal,
208'7" 3½" f wn sh impreg w iron carb;
2'3½" coal;
1½" carb sh w num coal lents;
2'8" coal - inf coal at 1'0"-1'2½" & in bott. 4"
214'1⅛"
1'7" gy sh - few slicks;
Overall Recovery
80·8%

N.S.177


A% 30·5
S.G 1·569
Wash at S.G 1·8*
Discard % 27·3
Floats A% 17·3
100·
99·3/58
gy sh - slts in bottom 2";
carb sh - bluey in bottom half;
coal, inf in bottom ½"; 1" bl sh;
4¼" coal; ¾" br sh lens;
4¼" coal;
1" carb sh with two ¼" lenses br sh;
coal, ¼" carb sh, ¼" dk gy sh,
2½" carb sh;
coal; ¾" br sh; 1¼" carb sh; 1" coal; ¾" f wn sh;
3" carb sh,
1'8" coal;
½" carb sh; 1" gy sh;
901'0½" 3" coal; ¾" carb sh; 1" coal;
14" dk gy sh;
Overall Recovery
100%

N.S.172


A% 45·3
100·
1506/61
A% 28·3
100·
1507/61
1508/61 composite of above 2 samples in ratio 1:2
A% 34·1
S.G 1·603
Wash at S.G. 1·8+
Discard % 25·6
Floats A% 21·8
10½" l gy sh;
509'0" 1¼" interb coal & carb sh;
7½" carb sh w coal lens in bott 3"
5½" creamy wh friable sh; 1½" carb sh - inf coal;
1¼" f wn sh; 1¾" carb sh; ¾" coal; ½" l f wn sh;
½" coal; 3½" f wn sh; ¾" carb sh;
½" coal; 2½" carb sh w few coal lens
3¼" dk gy sh, friable in bott 1½";
512'0" 5" carb sh w ½" dk gy sh at 2⅜" & ½" dk gy sh arenite
9½" coal & inf coal bands w ½" f wn sh at 3¼" & at 3¾";
3¾" carb sh w ¾" coal at 2½"; ¼" f wn sh.;
1" carb sh - inf coal; ¾" carb sh w coal lam.;
513'10¼" 2½" coal w sh partings at 3⅜" & 1½"; 1¾" f wn sh; ⅜" carb sh
½" coal; 1" carb sh w coal lens, 1¾" f wn sh; ½" carb sh w coal lens; 2" coal - inf coal in bott ½"; ¼" f wn sh;
2½" coal, ½" boulder,
1'2" coal w ¼" carb sh at 10";
½" dk gy sh; 3¾" coal w carb sh lam;
2¾" carb sh w coal lens; ¾" f usain; ½" coal;
½" carb sh; 1" coal w carb sh lam in mid;
¼" dk gy sh; ⅔" carb sh; 1" coal; 2⅛" inf coal;
1" carb sh; ½" inf coal; 1¾" carb sh w coal lens,
517'8" ¾" coal; 4" inf coal; ½" dk gy sh, 2⅜" interb coal
517'9¾" & carb sh; 1" dk gy sh w carb lam.; ¾" carb sh w coal lam;
1'8¾" dk gy sh - carb sh;
Overall Recovery
100%

+ See Table 1 for details of washability tests and analyses

P.D.T.S. No.5 MINE AREA
BOX FLAT
SKELETON PLAN SHOWING
STRUCTURE CONTOURS
BLUFF SEAM

To accompany report by H.R.E.Staines B.Sc., Geologist

SCALE OF CHAINS
10 0 10

Contours drawn on floor of Seam at 50' intervals
Elevations in feet on State Datum

6000 W 4000 W 2000 W 2000 E 4000 E 6000 E 8000 E

12000 N 10000 N 8000 N 6000 N 4000 N 2000 N

Q.1.2
Q.1.1 RL SURF. 306·27 RL BLUFF -17 06
N.S.174
N.S.172 RL SURF 110 15 RL BLUFF -219 41
N.S.175
WEST MORETON A RL SURF. 99·5 RL BLUFF -744·67
FAULT
ABERDARE
WEST MORETON FAULT
EXTENDED FAULT
MAFEKING FAULT
Walkers Sh.
N.S.177 RL SURF 97 50 RL BLUFF -333 66
Ab.Extd.1
Ab.Extd.2
ABERDARE EXTD No.2 A
ABERDARE EXTD No.1 A
N.S.181 RL SURF 105 50 RL BLUFF -378 63
N.S.178 RL SURF 89·31 RL BLUFF -605 36
N.S.180 RL SURF 89·75 RL BLUFF -369 63
N.S.183 RL SURF 130·27 RL BLUFF -1227·56
N.S.27 RL SURF 90·40 RL BLUFF -832 66
N.S.26 RL SURF 134 72 RL BLUFF -437 44
Q.1.5 RL SURF 89 13 RL BLUFF -360 83
N.S.168 RL SURF 106 90 RL BLUFF -281 31
McQueens Sh.
Box Flat Air Sh.
N.S.179 RL SURF 85·50 RL BLUFF -517 80
N.S.182A RL SURF 110 87 RL BLUFF -573 09
BOX FLAT A
N.S.139
NOBLEVALE No 5 A
BOGSIDE No 3
Q.1.6 RL SURF 104·76 RL BLUFF -669 24
N.S.176 RL SURF 111 65 RL BLUFF -421 46
NOBLEVALE No 3 A

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 306

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 16. P.D.T.S. No. 15 MINE AREA, MOGGILL

By I. B. FREYTAG, B.Sc. (Hons.), Geologist

BRISBANE
By Authority: S. G. REID, Government Printer
1963

SUMMARY

Diamond drilling of the Moggill mine area was undertaken to provide an assessment of total reserves available for the washing plant then being installed at the colliery.

In addition to an earlier hole to 523 ft. twelve holes were drilled with total footage of 5,338 ft. 7 in.

Because considerable variation in thickness and quality of the highly banded seams was expected, a closer bore spacing than is usually regarded as satisfactory for the field was decided on.

This report sets out the results of drilling which emphasise the irregular nature of deposition in the area as shown by marked variation in both stratigraphic sections and seam quality.

Reserves have been calculated on the basis of current mining practice and beneficiation at the colliery, which allows hand picking of stone underground and a maximum discard in washing of 38 per cent to produce 25 per cent ash coal.

Total reserves of unwashed coal have been calculated in four seams as:—

Measured	..	2,270,000 tons
Indicated	..	650,000 tons

H. G. S. CRIBB,
Assistant Chief Government Geologist.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 16. P.D.T.S. No. 15 MINE AREA, MOGGILL

I. INTRODUCTION

Moggill Colliery is situated in a pocket on the northern side of the Brisbane River opposite and to the north-north-west of the township of Redbank. The colliery is operated from a tunnel driven in portion 97, parish of Moggill, and workings underlie an area in the southern part of Coal Mining License No. 359 (see Fig. 1). Prior to December, 1956, the lease was held by Riverside Colliery, the present tunnel then being Riverside No. 2. Average daily production is 110 tons from Riverside No. 2 seam.

Riverside Nos. 1 and 3 Collieries, which worked the Riverside No. 1 seam, are both abandoned and inaccessible. Mining operations on this seam were concluded in the No. 1 pit during January, 1947.

The Moggill area was recommended by Messrs. Powell Duffryn Technical Services Ltd. in 1949 for diamond drilling as P.D.T.S. No. 15 Mine Area.

In November, 1958, Mines Department borehole N.S. 190 was put down ahead of the present workings to investigate deterioriation of the No. 2 seam encountered in the south-western faces in the mine. The results of this drilling were given in a report by R. W. Battaglene (1959).

A systematic drilling programme to test all seams known in the area was commenced on 24th January, 1961 and completed on 19th July, 1961. During this period, twelve holes numbered N.S. 223, 225, 227 (re-drill), 228, 230 (abandoned), 231-235, 237 and 240 were drilled by the Department's Sullivan 200A rig.

Apart from the re-drill and the hole abandoned, individual holes ranged in depth from 381 ft. 10 in. (N.S. 233) to 604 ft. (N.S. 237). The aggregate depth drilled, including N.S. 190, was 5,861 ft. 7 in. of which some 4,947 ft. was cored. Overall core recovery was 97 per cent with 94 per cent in coal seams.

Cores were logged by the writer and D. C. Mengel, Geologist. Those from the coal seams were inspected by representatives of the Queensland Coal Board and sampling intervals were selected on the basis of current mining practice.

This report is accompanied by the following plans and sections:—

Fig. 1.—Locality plan.

Fig. 2.—Plan showing topography, surface features, geology and boresites.

Fig. 3.—Plan showing mine workings, underground samples, boresites and limits of calculated reserves.

Fig. 4.—Sheet showing three geological cross sections.

Fig. 5.—Generalised borehole sections.

Fig. 6.—Detailed sections of Riverside No. 1A seam.

Fig. 7.—Detailed sections of Riverside No. 1B seam.

Figs. 8a, b, c.—Detailed sections of Riverside No. 2 seam.

Figs. 9a, b, c.—Detailed sections of Riverside No. 3 seam.

Fig. 10.—Correlation diagram of Riverside No. 3 seam and Westfalen Middle seam.

II. SURFACE GEOLOGY

A paucity of rock exposures in Moggill Pocket is due to the occurrence, over most of the area, of a thick deposit of high-level river alluvium. Cliffs of sandstone in the bank of the Brisbane River in pors. 94, 99 and 100 and also a shale-sandstone outcrop in a creek bed in por. 97, previously recorded, belong to the Ipswich Coal Measures.

Coal seam crops are unknown in the report area. A white, fine sandstone, recently discovered just below the surface of the roadway along the eastern boundary of por. 94, is thought to be the roof sandstone of Riverside No. 2 seam.

Dark-coloured clays cropping out to the north of the creek in pors. 97 and 100 are probably derived from Tertiary sediments.

III. STRATIGRAPHY

(a) Alluvium (Quaternary)

All boreholes penetrated a thickness of alluvium ranging from 35 ft. in N.S. 233 to 78 ft. in N.S. 223 and consisting mainly of unconsolidated clayey silt interbedded with sands of varying grain size. Gravel and boulder beds occur at or near its base and thin, pale grey mudstones were present in N.S. 231 and 240.

No Tertiary sediments were intersected.

(b) Ipswich Coal Measures (Middle Triassic)

The layered sequence which includes the Riverside coal seams comprises interbedded shales, siltstones and light-coloured, sometimes pebbly sandstones, all of which are comparable in lithologies with the upper units of the Ipswich Coal Measures.

Sandstone lenses which cause rapid divergences both within and between the recognized coal seams are a feature of the succession at Moggill, evident in the geological cross-sections (see Fig. 4).

The seams intersected in the boreholes are, in descending order, as follows:—

Riverside No. 1
Riverside No. 1A (previously unnamed)
Riverside No. 1B (previously unnamed)
Riverside No. 2
Riverside No. 3
Riverside No. 4 (previously unnamed)

Table A shows the variations in intervals between the Riverside coal seams.

Drilling was normally terminated in massive sandstone underlying No. 4 seam. This sandstone, at least 90 ft. thick in N.S. 233, has a conglomeratic zone within the top 35 ft.

TABLE A

INTERVALS BETWEEN COAL SEAMS (to nearest foot)

Borehole	N.S. 190	N.S. 223	N.S. 225/227	N.S. 228	N.S. 230/231	N.S. 232	N.S. 233	N.S. 234	N.S. 235	N.S. 237	N.S. 240
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
Riverside No. 1 to Riverside No. 1A ..	29	4	14	25	26	*	*	*	*	35†	25†
Riverside No. 1A to Riverside No. 1B ..	22	6	10	22	58	*	*	*	51	37	15
Riverside No. 1B to Riverside No. 2 ..	61	40†	62	41	35	57	*	52	54	36	37
Riverside No. 2 to Riverside No. 3 ..	84	80†	102	100	78	73	67	67	72	100	114
Riverside No. 3 to Riverside No. 4 ..	22	26	5	13	39	30	33	49	46	14	1

* Upper seam not present in borehole.
† Figure approximate owing to open hole drilling.

(c) The stratigraphic position of the Riverside coal seams

This has long been open to doubt. Denmead (1955a) pointed out that this was due to their isolated situation with respect to established stratigraphic horizons, to a changing nature of sedimentation approaching the Moggill area and to the dissimilarity of the coal sections from those of recognised seams in other localities. He suspected that the Riverside seams (Nos. 1, 2 and 3) lay above the presumed extension of the Garden seam, the top of which is used to define arbitrarily the boundary between the Cooneana Formation and the underlying Tivoli Formation (Allen and Staines, 1959, 35-36).

As a result of drilling in the Westfalen No. 2 mine area, Staines (1957) correlated a dolerite sill lying between the Westfalen Middle and Top seams with the igneous replacement of the assumed Garden seam at Haighmoor (Denmead, 1955b). Westfalen mine area is approximately two miles west of the Moggill area.

Borehole sequences at Moggill bear no definite resemblance to those at Westfalen, but the equivalence of the thick sandstone below Riverside No. 4 seam at Moggill to that below Westfalen Bottom seam in N.S. 94 and N.S. 103 is strongly suspected.

An attempted detailed correlation of individual seams in the two areas, disclosed a broad but positive similarity between Riverside No. 3 seam and several borehole sections of the Westfalen Middle seam (see Fig. 10). The distribution of groups of shale bands and "badgers" in relation to clean coal and inferior coal shows similar regularity in both seams.

Furthermore, the projected outcrops of the Riverside Nos. 2 and 3 seams lie close to the line of strike of the Westfalen seams, if small differences in surface elevation and the possibility of intervening faulting are ignored.

The above evidence is, in the writer's opinion, sufficient to propose that Riverside Nos. 3 and 4 seams are of Tivoli age, but the validity of this is dependent largely on the position of the assumed Garden seam horizon at Westfalen. The proposition does not infer the equivalence of Westfalen Top seam to Riverside No. 2 seam and the Tivoli-Cooneana boundary cannot at present be placed more accurately than somewhere above the Riverside No. 3 seam. This division is substantiated by certain fossil plant species found in the Moggill drill core.

J. T. Woods (see Appendix I) identified fifteen plant species from an horizon about 100 ft. below Riverside No. 3 seam in N.S. 231, including *Dicroidium coriaceum* with a preponderance of deeply dentate leaves, *Linguifolium* sp. and *Cladophlebis johnstoni*. This assemblage led him to suggest a Tivoli age for this horizon, which in N.S. 240 contained *Ctenis* sp., a species also referable to the Tivoli Formation (Appendix II).

Siltstones in the split between Riverside No. 2 "tops" and "bottoms" in N.S. 240 contained *Dicroidium coriaceum* which suggests possible Tivoli age for the No. 2 seam.

IV. STRUCTURAL GEOLOGY

(a) General structure

Structure contours on the bases of Riverside Nos. 2 and 3 seams express a local strike very close to due east and a true gradient of about 1 in 9 (6 deg.) to the south exists over much of the area drilled. In the north-east, however, the strata steepen slightly to 1 in 5½ (10 deg.), and in the southern part flattening and reversal of dip along a line in the vicinity of N.S. 237, 228 and 225 produce a very open syncline plunging at about 3 deg. to the west-south-west. This syncline conforms with the structural basin proved by the mining of Riverside No. 1 seam (Denmead, 1955a).

(b) Faulting

Faulting in the Moggill mine area is of uncertain type and degree, but it appears to be of minor importance. Faults were recorded, without attitude, in Riverside No. 3 pit and small faults have been observed in the present Moggill workings. In general, they form a sub-parallel set striking approximately south-east.

Faulted sections in boreholes N.S. 228 and N.S. 231 cannot be related satisfactorily to any of the known faults.

The deterioration of Riverside No. 2 seam in the south-western faces of the mine is accompanied by minor faulting which is seen in the top section of the seam but in most cases does not cut the roof sandstone. These faults, dipping at 30-35 deg. south-westerly, have a normal displacement with a throw where observed of less than 3 inches. They are distributed throughout a zone probably adjacent to a larger fault to the south-west. The presence of such a fault is inferred from the offset of structure contours on the base of the No. 2 seam which indicates an upthrow to the south-west. The attitude of the fault is unknown but a throw of the order of 5 ft. appears to diminish north-westerly.

V. COAL SEAMS

In general, the Riverside seams contain numerous shale bands, the majority of which, when not carbonaceous, are fawn or brownish in colour. Shale with disseminated calcareous nodules, and thin beds and veinlets of limestone occur in some of the seam sections.

(a) Riverside No. 1 Seam

The uppermost seam worked in the Moggill area is the Riverside No. 1 seam. However, a coaly section occurs at about 65 ft. above it in N.S. 228 and Denmead (personal communication) also observed a seam above the No. 1 seam in the airshaft of No. 3 colliery.

Riverside No. 1 seam was worked by Riverside No. 1 Colliery until it was flooded in 1931, and later by Riverside No. 3 Colliery. Mining of this seam was brought to an end in 1947 after No. 1 pit had been reopened for a short while.

The seam is reported to have averaged 5 ft. 7 in. in thickness and, in addition to including five or six thin stone bands, it was divided near the middle by a "badger" approximately 12 in. thick (Denmead, 1955a). Borehole sections correspond to this description.

Analyses of this seam in N.S. 190 gave an ash value of 20·5 per cent with the "badger" excluded and 28·6 per cent. for the complete seam.

(b) Riverside No. 1A Seam

Riverside No. 1A seam is generally separated from the overlying workings on the No. 1 seam by 25 to 35 ft. of siltstone with thin shale and sandstone bands, but the two seams converge easterly and have as little as 4 ft. of strata between them in N.S. 223. With respect to mining, this interval is increased by some 7 to 15 ft. of shale and coal, because the workable section is at the bottom of the No. 1A seam.

In those boreholes sited on or east of Moggill Road, Riverside No. 1A seam was found to be a single section averaging 13 ft. thick, but west of Moggill Road the seam splits and, on the whole, deteriorates. It rises to the NNW. and has been eroded away in N.S. 232, 233 and 234.

The No. 1A seam consists of interbedded shale and coal in the top portion, separated by about 18 in. of stone from the bottom section of coal with several thin shale bands. The latter has been proved workable in N.S. 190, 223, 227, 228 and 240. Thickness of the workable section ranges from 2 ft. 11½ in. in N.S. 190 to 5 ft. in N.S. 223, increasing from west to east.

There appears to be an improvement in the upper portion of the seam in the south-east of the area drilled.

(c) Riverside No. 1B Seam

The absence of coal reported by the management between Riverside Nos. 1 and 2 seams in a percussion bore in por. 95 (Battaglene, 1959) seems due to misidentification of the first seam intersected. It was taken to be the No. 1 seam, but was almost certainly Riverside No. 1B seam.

Workable coal occurs at the top of the No. 1B seam, so that the interval between it and Riverside No. 1A seam is also that between possible future mine workings in the two of them (see Table A). In the easternmost boreholes, Nos. 1A and 1B seams are separated by 6 to 15 ft. of shale and siltstone, but this interval grows westwards with the presence of a thickening sandstone lens. In N.S. 231 and 233 the interval, most of which is occupied by massive sandstone, exceeds 50 ft.

Riverside No. 1B seam is undivided in only two boreholes, N.S. 232 and 235, in the north-west of the area drilled, where it averages 24 ft. in thickness. Elsewhere the seam features progressive splitting in easterly and southerly directions, to the extent that in N.S. 240 it consists of four separate coaly sections in a thickness of some 64 ft.

In N.S. 233 the entire seam has been removed by erosion and in N.S. 234 its quality is indeterminate because its full section was not cored.

A workable section of coal, usually with a sandstone roof ideal in mining, occurs in boreholes N.S. 190, 223, 227, 228, 231 and 240. Thickening from north to south, it ranges from 3 ft. 6¼ in. in N.S. 223

to 6 ft. in N.S. 228, but not all the sections are equivalent. Scouring prior to the deposition of the roof sandstone is probably responsible for the removal of most of the top coal in N.S. 235 and 237 and its reduction to 2 ft. 4¾ in. in N.S. 232.

As many as a dozen shale bands, mostly not exceeding 1 in. thick, are distributed throughout the workable coal. One band, however, generally averages 7 in. in thickness, and grows to 2 ft. in N.S. 237, thereby making the seam unworkable in this vicinity. This band has been excluded from the samples analysed except in N.S. 190 and 223 where, owing to a diminished proportion of coal beneath it, it has been chosen as the floor.

Some 3 ft. of coal with several thin shale bands, occurring at the bottom of Riverside No. 1B in N.S. 231 and 237, is of limited extent and is considered unimportant at present.

(d) Riverside No. 2 Seam

Riverside No. 2 seam lies from 35 ft. to more than 60 ft. below the base of the No. 1B seam. This interval is occupied by interbedded shales and siltstones with thin sandstones, usually overlying a sandstone unit up to 30 ft. thick resting on the No. 2 seam.

Mining of Riverside No. 2 seam in pors. 93, 95, 96 and 192 has established a total seam thickness of 18 to 19 ft. Drilling, however, has disclosed a gradual thickening of the seam section southwards. From the vicinity of a line joining N.S. 225 and N.S. 231, a sandstone-shale facies in the middle of the seam thickens rapidly so that an interval of some 44 ft. separates the top section from the bottom in the most southerly holes, N.S. 237 and 240.

Coal has been extracted from the top and bottom sections of the seam which, where worked, are separated by alternating bands of shale, "bluey" and coal. In the early stages of development, a section 2 ft. 9½ in. thick was worked in the middle of the seam, and was then called the "tops" (Denmead, 1955a).

The poor quality of the working sections to the south-west of the mine was shown by the drilling to be more persistent in the bottom section than in the top. The "tops" are again workable in boreholes further to the south-west but in only N.S. 235 and N.S. 237 are the "bottoms" of interest.

(i) **Riverside No. 2 "tops".**—The topmost section of the No. 2 seam has been mined in thicknesses usually ranging from 3½ ft. to 4 ft. utilising a 4 in. fawn shale band as the floor. This section carries up to a dozen shale bands, seldom reaching 2 in. thick. Their sudden thickening near the south-western faces of the mine, accompanied by changes from coal to carbonaceous shale, is there responsible for deterioration of the seam (see section M/R2t/4, Fig. 8c). Drilling has proved workable top coal in N.S. 228, 231, 233, 235 and 237 and also a section of workable quality, 2 ft. 10 in. thick, in N.S. 240.

(ii) **Riverside No. 2 "bottoms".**—Where it has been worked, the No. 2 "bottoms" has maintained a fairly constant section averaging 4½ to 5 ft. in thickness. It consisted of coal, often inferior in the upper part, with a 3 to 5 in. fawn shale band just above the middle. Below this band were as many as eight thin shale bands, and two or three more above it (see section M/R2b/3, Fig. 8c). A section of banded shales has provided the roof in the workings.

Boreholes reveal bottom sections of the No. 2 seam basically similar to those in the mine, but all except those in N.S. 233, 235 and 237 are made unworkable by an increase in the number of stone bands. The sections in these three holes measured 5 ft. 2¼ in., 5 ft. 7 in. and 4 ft. respectively.

(c) Riverside No. 3 Seam

The Riverside No. 3 seam was exposed in a trial shaft in por. 97, where it was reported to be 13 ft. 5 in. thick at 59 ft. depth (Denmead, 1955a). An additional overlying 3 ft. 9 in. of "bluey" and shale is now included as the uppermost part of the seam. The bottom 3 ft. was considered to be the only workable section in the shaft.

Later, an inclined drift beneath the main dip of the then Riverside No. 2 workings cut the No. 3 seam at about 16 chains from the portal (see Fig. 3). Here, 15 ft. 5½ in. of "coal measures" (see Fig. 9b) was recorded in 1960 during sampling of the No. 3 seam by officers of the Queensland Coal Board. As a result of exhaustive sectional testing, the coal was shown to have a high inherent ash and there was no section of workable quality "as mined".

Both the above seam sections can be identified with those of Riverside No. 3 seam intersected in the eleven boreholes, in which it ranged from 16 ft. 7¼ in. thick in N.S. 235 to 20 ft. 2¾ in. in N.S. 228, and averaged 18 ft. 6 in.

The No. 3 seam is separated from Riverside No. 2 seam by a sequence, averaging 85 ft. in thickness, of siltstones and shales containing a coaly horizon less than one foot thick, persistent throughout the area drilled.

For appraisal, the Riverside No. 3 seam, which is strongly banded, can be divided into the following four sections:—

(i) **No. 3 "tops".**—The top section averages 5 ft. 11 in. in thickness, though it varies from 4 ft. 8 in. in N.S. 190 to 7 ft. in N.S. 231 and 234. It is quite unworkable consisting of interbedded shale, carbonaceous shale and "bluey", with a few thin coal plies.

(ii) **No. 3 middle coal.**—Immediately below the "tops" is a section, averaging 4 ft. 1½ in., of clean coal with two consistent "badgers". The upper "badger", at the middle of the coal section, does not exceed 9 in. and consists of several fawn shale

bands separated by coal and carbonaceous shale. The lower "badger" is less than one foot from the bottom of the coal section and is generally 4 in. to 7 in. thick.

No. 3 middle coal has been proved of workable quality in all boreholes except N.S. 223 and 225, in which it has not been sampled separately.

(iii) **No. 3 middle stone.**—A section of stone consisting of fawn shale bands interbedded with carbonaceous shale and a few thin plies of coal, often inferior, separates the middle and bottom coal. The stone averages 1 ft. 11 in. in thickness.

(iv) **No. 3 bottom coal.**—An average thickof 6 ft. 7 in. of coal with numerous shale bands occurs at the bottom of the No. 3 seam. The lowest 3 ft. or so is usually of cleaner appearance than the remainder but in N.S. 231 the whole section consists of coal with only a few thin shale bands. In contrast, the section in N.S. 240 is so banded that it was not sampled.

On the whole, the quality of Riverside No. 3 bottom coal is inferior to that required at present. Coal which could be washed to give 25 per cent ash does occur in boreholes N.S. 190, 223, 231, 234 and 235, and these sections are discussed with regard to the estimation of reserves.

(f) Riverside No. 4 Seam.

The predominantly coaly shale sequence between Riverside No. 3 seam and the massive sandstone at the bottom of the boreholes has been named Riverside No. 4 seam. In N.S. 225 and 240 it presents a continuous coaly section some 65 ft. and 68 ft. thick respectively, but in other boreholes it is split, usually into two parts.

The interval between Riverside Nos. 3 and 4 seams varies from 1 ft. of shale in N.S. 240, to nearly 50 ft. of sandstone, siltstone, and shale in N.S. 234.

Although there is a thin development of coal at the top of the seam in N.S. 228, 232 and 237, drilling has indicated nothing of potential workability in Riverside No. 4 seam.

VI. NATURE OF COAL

The Riverside coals are high volatile bituminous in rank. Fixed carbon values, calculated on a dry mineral-matter-free basis from 44 analyses, range from 63·6 to 68·9 per cent and average 66·2 per cent. These figures do not take into account two samples of medium volatile bituminous rank with 69·0 per cent and 69·3 per cent fixed carbon respectively.

An average of 64·5 per cent fixed carbon (six analyses) in Riverside No. 1B coal is distinctly lower than in other seams. In the Riverside No. 2 "bottoms", the average is 67·1 per cent (five analyses), and in the No. 3 bottom coal 67·0 per cent (nine analyses).

The average moisture content of the respective seams shows little variation and ranges from 1·5 per cent in Riverside No. 3 seam to 1·8 in both Riverside No. 1A seam and the No. 2 "bottoms". Individual moisture determinations vary from 1·2 to 2·2 per cent.

Sulphur content of the washed coal from Riverside Nos. 1A and 1B seams averages 0·50 per cent varying from 0·40 to 0·61 per cent, but in coal from the underlying seams it ranges from 0·30 to 0·61 per cent (average 0·42 per cent). Two values of 0·20 per cent and 0·77 per cent which are exceptional, have not been included.

Coal from the Riverside seams with an ash content of 25 per cent would have an estimated calorific value of some 11,000 B.T.U. per lb. Coal carrying 30 per cent ash would produce about 10,000 B.T.U. per lb.

Specific gravity of Riverside coal of 25 per cent ash is 1·47–1·48.

Coking tests on more than 50 samples indicate that Riverside coals, in general, have medium coking properties with a tendency to be weakly coking, particularly in Riverside No. 2 "bottoms" and in the Riverside No. 3 seam. Swelling indices have a wide range from 2 to 8½, with the majority between 5 and 7.

VII. COAL RESERVES

Included in measured reserves are those seam sections which, considered workable on the basis of the present mining and beneficiation methods at Moggill Colliery,

(1) have a minimum thickness of 3 ft., and

(2) provide by the discard of not more than 38 per cent by weight, a washed coal with an ash value not exceeding 25 per cent.

The relatively high ash content of the Riverside seams necessitates beneficiation for the production of marketable coal and therefore washability tests were done on all samples (crushed to –½ inch). Wherever practicable, the theoretical discard has been deduced using a formula supplied by the Queensland Coal Board to give a constant ash of "floats" of 25 per cent.

The area of measured reserves is taken as that bounded by a line extending five chains beyond peripheral points of workability, either in drill hole or underground section. The five chains extension of reserves has in cases of marginal quality or thickness been reduced at the writer's discretion.

Estimates of reserves assume complete extraction and make no allowance for losses in mining and the unavailability of coal due to faulting.

(a) Riverside No. 1 Seam

There are no reserves in this seam.

(b) Riverside No. 1A Seam

Measured reserves of 380,000 tons have been calculated in an area of 48·9 acres embracing boreholes N.S. 190, 223, 227, 228 and 240. The workable section averages 4 ft. 1¾ in. in thickness. The coal has a weighted average ash content of 29·2 per cent and a corresponding specific gravity of 1·53.

Approximately the western half of the reserves area underlies, at an interval of 13 to 40 ft., the old No. 1 seam workings.

The varying results of the four washability tests available for this seam do not give a fair indication of the effect of washing in practice. However, they do suggest that in a medium of specific gravity 1·8 washed coal of 25 per cent ash would be obtained by an average discard not exceeding 10 per cent, thereby producing at least 340,000 tons of marketable coal.

(c) Riverside No. 1B Seam

A block of coal 61·3 acres in area and averaging 4 ft. 6½ in. thick has been determined by boreholes N.S. 190, 223, 227, 228, 231 and 240. It represents a gross tonnage of 550,000 tons which has a weighted average ash content of 35·8 per cent and a corresponding specific gravity of 1·63.

The thick shale band within the workable section in N.S. 228, 231 and 240 averages 9 in. in thickness and amounts to about 60,000 tons. This stone could be discarded underground and the remaining coal would amount to 490,000 tons. Washing would give a product containing 25 per cent ash by the discard of about 6 per cent by weight in a medium of specific gravity 1·8. Reserves of marketable coal in this category have been calculated at about 450,000 tons.

(d) Riverside No. 2 Seam

(i) **"Tops"**—Measured reserves of 190,000 tons occur as a block of coal in the south-west of the report area surrounding bores N.S. 228, 231, 235 and 237. The average working thickness is 3 ft. 6 in. and the area is 28·9 acres. The weighted average ash content is 35·5 per cent and the corresponding specific gravity is 1·57.

Washability tests show that in a medium of specific gravity 1·8, discards ranging from 2·0 per cent to 28·7 per cent would produce coal of 25 per cent ash content. If the average discard is assumed to be 20 per cent, reserves of marketable coal of 25 per cent ash are 150,000 tons.

(ii) **"Bottoms".**—The workable quality of No. 2 "bottoms" in N.S. 233 and mine sample M/R2b/3 is assumed to continue eastwards to the limits of Moggill workings, inaccessible in this section. The coal has a weighted average ash content of 40·5 per cent and corresponding specific gravity of 1·67. Therefore, indicated reserves which cover an area of 19·1 acres and average 4 ft. 9½ in. thick have been calculated at 180,000 tons.

If the consistent 4 in. shale band in the section were removed prior to washing, 160,000 tons of unwashed coal would be available.

Washability tests show that in a medium of 1·8, discards of 29·2 and 15·8 per cent in the borehole and mine samples respectively would be necessary to produce coal of 25 per cent ash content. It may be expected that this would result in the production of about 120,000 tons of washed coal.

(e) Riverside No. 3 Seam

Stone bands in the No. 3 seam sections, the behaviour of which was previously unknown, were found as drilling progressed to vary in thickness from place to place. It was unavoidable therefore, that in progressive sampling of the seams the exclusion from samples of thicker stone bands in some places and not in others has produced some inconsistencies in the samples submitted for washing tests.

(i) **Middle coal.**—Measured reserves of 780,000 tons have been calculated for an area of 96·6 acres embracing all boreholes except N.S. 223 and 225. The coal section averages 3 ft. 11¼ in. in thickness; the weighted average ash content is 40·8 per cent; and the corresponding specific gravity 1·69.

In general, if the thicker stone bands were excluded manually, tests indicate that washing of the remaining coal in a medium of 1·8 would give, by the discard of about 25 per cent by weight, a coal product with an ash content of 25 per cent. This would amount to at least 500,000 tons.

Indicated reserves of about 490,000 tons have been calculated in an area of 57·4 acres which includes N.S. 223, 225 and underground sample M/R3/1. At these points, the middle coal was not analysed separately. It is to be expected, however, that the ash content would be comparable with that in other sections of the middle coal which is approximately 41 per cent.

The average seam thickness is 4 ft. 1½ in. It is expected that this coal would give a similar result on washing to the measured reserves, so that some 300,000 tons of washed coal could be available.

(ii) **Bottom coal.**—A large block of coal exists at the bottom of the No. 3 seam but its quality on the whole is inferior to that required for present mining. Coal which could be mined at present occurs in an area of 47 acres including boreholes N.S. 190, 223, 231 and 235. Average seam thickness is 4 ft. 7¼ in., the weighted average ash of coal 37·1 per cent and the corresponding specific gravity 1·64.

Measured reserves have been calculated as 430,000 tons.

Washability tests on four samples indicate that in a medium of specific gravity 1·8, washing could produce coal with an ash content of 25 per cent by discarding an amount ranging from 8·1 to 35·0 per cent by weight. This would provide at least 300,000 tons of washed coal.

VIII. CONCLUSION

Eleven diamond drill holes in the Moggill mine area have proved coal reserves totalling 2,920,000 tons, of which 2,270,000 tons are in the category of measured reserves and 650,000 tons are indicated reserves.

Summarizing, calculated total reserves of unwashed coal in individual seams are as follows:—

Riverside No. 1A seam	380,000 tons (measured)
Riverside No. 1B seam	490,000 tons (measured)
Riverside No. 2 seam ("tops") . .	190,000 tons (measured)
Riverside No. 2 seam ("bottoms") . .	160,000 tons (indicated)
Riverside No. 3 seam (middle coal) . .	780,000 tons (measured)
Riverside No. 3 seam (middle coal) . .	490,000 tons (indicated)
Riverside No. 3 seam (bottom coal)	430,000 tons (measured)

Washing tests of the coal sections excluding stone removed underground indicate that if the coal were washed in a medium of specific gravity 1·8 the total washed product would amount to some 2,200,000 tons.

REFERENCES

ALLEN, R. J., and STAINES, H. R. E., 1959: New names in Queensland stratigraphy. Ipswich Coal Measures. *Aust. Oil Gas J., 5 (11)*, 32-36; *(12)*, 27-28.

BATTAGLENE, R. W., (1959): Moggill colliery area, Ipswich coalfield. Unpub. rep. Geol. Surv. Qld.

DENMEAD, A. K., 1955a: The West Moreton (Ipswich) coalfield. *Geol. Surv. Qld Publ., 279.*

————, 1955b: Coal resources, West Moreton (Ipswich) coalfield. Part 3. P.D.T.S. No. 17 mine area, Haighmoor. *Geol. Surv. Qld Publ., 282.*

STAINES, H. R. E., 1957: Coal resources, West Moreton (Ipswich) coalfield. Part 7. Westfalen No. 2 mine area, Dinmore. *Geol. Surv. Qld Publ., 284.*

TABLE I

DETAILS OF WASHABILITY TESTS AND ANALYSES

Seam	Section	Drill-hole No. N.S.	Sample No.	Washability Tests								Analysis of Composite of Floats								
				Floats S.G. 1·4		Floats S.G. 1·6		Floats S.G. 1·8		Sinks S.G. 1·8		Moisture	Volatile Matter	Fixed Carbon	Ash	B.T.U.	Sulphur	Specific Gravity	Coking Classification	Swelling Index
				Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	%	%	%	%	per lb.				
Riverside No. 1A	bottom	190	1739/58*	..	..	..	..	..	..	..	..	1·8	27·5	49·8	20·9	11500	0·30	1·442	Cm	7½
	bottom	223	189/61†	43·5	11·3	9·1	25·7	4·1	29·3	43·3	55·3	1·6	29·0	54·4	15·0	12660	0·48	1·380	Cm	8
	whole	227	196/61†	28·5	12·0	25·2	26·3	12·3	39·1	34·0	73·5	1·8	26·4	49·4	22·4	11330	0·47	1·454	Cw	4½
	top	228	517/61	24·4	15·2	10·7	29·6	17·5	44·4	47·4	74·8	1·9	25·3	44·8	28·0	10420	0·48	1·488	Cw	4½
	bottom	228	520/61	42·9	11·2	23·5	26·2	8·8	39·9	24·8	72·9	1·5	29·1	50·7	18·7	12060	0·59	1·406	Cm	7
	bottom	237	909/61‡	..	..	73·8	18·0	13·6	41·2	12·6	71·8	2·0	26·7	50·1	21·2	11380	0·48	1·437	Cw/Cm	6½
	bottom	240	918/61‡	..	..	75·6	14·5	8·1	41·2	16·3	70·3	1·8	28·6	52·3	17·3	11520	0·48	1·405	Cm	5½
Riverside No. 1B	whole	190	1740/58*	..	..	..	..	..	..	..	..	2·2	26·5	43·6	27·7	10220	0·59	1·495	Cw	6½
	whole	223	190/61†	61·7	8·9	3·7	22·8	1·1	25·7	33·5	60·0	1·6	32·4	56·0	10·0	13310	0·44	1·328	Cm	8½
	whole	227	198/61†	57·6	7·8	16·3	31·2	8·4	39·7	17·7	71·0	1·5	31·0	51·8	15·7	12220	0·52	1·387	Cm	7½
	whole	228	521/61	60·3	9·0	10·2	27·3	4·8	41·1	24·7	76·2	1·6	31·2	53·6	13·6	12880	0·40	1·362	Cm	7½
	whole	231	649/61	41·4	12·6	24·5	29·1	9·2	40·7	24·9	73·1	1·8	26·6	50·1	21·5	11720	0·46	1·428	Cw	6½
	top	232	657/61	60·4	10·2	12·3	26·9	3·4	47·4	23·9	76·0	1·9	30·7	52·9	14·5	11500	0·48	1·388	Cm	8
	whole	240	919/61‡	..	..	65·7	11·8	8·4	39·7	25·9	67·3	1·8	31·2	52·1	14·9	12440	0·61	1·386	Cm	7
Riverside No. 2	bottom	225	194/61	35·7	12·8	13·2	28·2	10·2	35·7	40·9	73·6	1·7	28·7	51·3	18·3	12050	0·54	1·405	Cm	7
	top	228	523/61	58·1	12·3	20·1	27·3	6·0	39·7	15·8	74·7	1·5	29·8	51·1	17·6	12610	0·55	1·390	Cm	7
	top	231	652/61	31·5	13·8	25·3	28·0	13·7	41·9	29·5	72·6	1·6	26·3	47·7	24·4	11290	0·46	1·454	Cw	5½
	bottom	232	1410/61‡	..	..	51·3	25·1	18·1	44·7	30·6	72·3	1·8	23·0	45·2	30·0	10020	0·77	1·525	Cw	5
	top	233	661/61	28·7	15·1	29·6	30·5	18·4	43·5	23·3	75·3	1·8	25·6	45·0	27·6	10430	0·35	1·486	Cw/Cm	5
	bottom	233	662/61	32·8	13·5	22·8	27·8	10·0	41·1	34·4	74·1	1·8	26·5	49·1	22·6	11680	0·38	1·441	Cw/Cm	5½
	bottom	234	894/61	26·4	18·4	23·0	30·4	16·9	44·1	33·7	73·7	1·6	24·8	44·6	29·0	10250	0·34	1·515	Cw	5½
	top	235	901/61	28·3	13·7	28·2	27·8	13·1	43·8	30·4	74·7	1·4	26·0	48·3	24·3	11020	0·45	1·465	Cm	4
	bottom	235	902/61	33·7	12·7	22·8	28·1	9·3	39·7	34·3	73·4	1·6	26·9	49·4	22·1	11370	0·50	1·443	Cw/Cm	6½
	top	237	910/61‡	..	..	71·8	15·7	6·1	41·0	22·1	78·4	1·7	30·1	50·7	17·5	12100	0·40	1·394	Cm	6
	bottom	237	911/61‡	..	..	54·3	18·8	11·2	42·4	34·5	78·2	1·9	25·3	50·2	22·6	11300	0·42	1·455	Cw/Cm	6½
	top	240	921/61‡	..	..	65·6	22·0	5·3	42·4	29·1	73·6	1·5	25·4	48·7	24·4	11200	0·43	1·468	Cm	5½
Riverside No. 3	middle	223	191/61†	19·5	15·0	4·1	25·4	8·0	29·1	68·4	66·2	1·4	27·5	51·3	19·8	11690	0·44	1·424	Cm	7
	bottom	223	192/61†	25·6	15·4	7·0	26·9	6·0	34·2	61·4	61·0	1·4	26·9	51·2	20·5	11780	0·43	1·431	Cm	7½
	bottom	223	193/61	49·6	11·4	8·3	23·2	4·6	31·4	37·5	54·9	1·4	29·8	54·0	14·8	12270	0·52	1·377	Cm/Cs	8½
	top +	225	195/61	16·7	15·3	19·8	28·3	11·2	34·5	52·3	72·7	1·5	24·0	48·2	26·3	10690	0·37	1·496	Cw	3½
	bottom	225	514/61	14·9	18·1	12·6	25·2	23·1	37·9	49·4	63·4	1·6	22·9	46·3	29·2	10410	0·33	1·512	Cw	2
	bottom	225	516/61	17·7	15·4	8·5	25·5	14·5	32·6	59·3	60·9	1·6	24·4	50·2	23·8	11140	0·39	1·461	Cw	4½
	middle	228	524/61	33·2	12·7	18·2	27·7	14·9	41·1	33·7	76·0	1·6	26·0	49·3	23·1	11010	0·40	1·454	Cm	7
	bottom	228	525/61	23·3	19·2	20·0	30·1	19·6	41·8	37·1	69·7	1·6	23·0	45·9	29·5	10170	0·40	1·520	Cw	2½
	bottom	228	527/61	24·0	14·6	19·9	28·0	16·1	41·2	40·0	71·7	1·2	25·5	47·1	26·2	10810	0·34	1·484	Cm	5
	middle	231	653/61	23·6	12·0	26·1	29·0	16·8	41·3	33·5	68·1	1·7	25·5	46·9	25·9	10880	0·35	1·491	Cw	6
	bottom	231	655/61	17·6	13·1	19·0	28·4	17·7	41·0	45·7	73·8	1·7	23·6	47·4	27·3	10400	0·30	1·514	Af/Cw	4
	bottom	231	656/61	27·4	11·4	20·3	26·2	12·9	41·3	39·4	69·6	1·6	26·9	48·6	22·9	11180	0·46	1·461	Cm	6
	middle	232	658/61	32·6	11·9	19·7	26·4	12·1	38·9	35·6	71·6	1·7	28·1	48·8	21·4	11360	0·36	1·451	Cm	6½
	bottom	232	660/61	20·6	13·8	23·6	26·7	17·3	42·7	38·5	72·8	1·6	24·2	47·5	26·7	10880	0·39	1·492	Cw/Cm	4
	middle	233	664/61	27·7	13·1	22·8	26·8	11·2	44·1	38·3	75·8	1·8	26·9	48·2	23·1	11070	0·34	1·464	Cw/Cm	5
	bottom	233	667/61	19·9	12·9	26·4	27·9	14·1	43·1	39·6	73·0	1·7	24·6	47·4	26·3	10500	0·41	1·504	Cw	2

TABLE I (*Continued*)

DETAILS OF WASHABILITY TESTS AND ANALYSES

Seam	Section	Drill-hole No. N.S.	Sample No.	Washability Tests								Analysis of Composite of Floats								
				Floats S.G. 1·4		Floats S.G. 1·6		Floats S.G. 1·8		Sinks S.G. 1·8		Moisture	Volatile Matter	Fixed Carbon	Ash	B.T.U.	Sulphur	Specific Gravity	Coking Classification	Swelling Index
				Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	%	%	%	%	per lb.				
Riverside No. 3	middle	234	896/61	32·4	13·0	25·2	27·5	14·0	40·5	28·4	73·1	1·6	26·3	48·4	23·7	10990	0·20	1·468	Cw	6
	bottom	234	899/61	24·1	13·7	21·7	29·1	19·3	42·8	34·9	74·9	1·6	25·1	46·2	27·1	9990	0·37	1·495	Cw	6
	middle	235	904/61	33·8	10·2	22·1	25·2	23·2	40·3	20·9	70·7	1·5	27·6	47·3	23·6	10610	0·30	1·464	Cw/Cm	6½
	bottom	235	907/61‡	..	..	48·6	18·5	15·1	43·2	36·3	71·4	1·8	26·0	48·0	24·2	10890	0·47	1·476	Cw/Cm	5½
	middle	237	913/61‡	..	..	59·7	21·6	10·8	41·7	29·5	73·0	1·6	26·3	48·2	24·9	10940	0·39	1·468	Cm	5
	bottom	237	917/61‡	..	..	48·6	22·8	17·8	44·4	33·6	70·7	1·4	23·8	46·0	28·8	10160	0·34	1·511	Cm	4
	middle	240	922/61‡	..	..	66·0	16·7	10·7	39·9	23·3	77·9	1·7	29·3	50·6	18·4	12100	0·50	1·351	Cm	6½
	middle	190	1412/61‡	..	..	68·0	19·1	13·7	40·4	18·3	68·4	1·9	25·9	48·7	23·5	11100	0·61	1·474	Cw	6½
	bottom	190	1414/61‡	..	..	46·5	21·6	22·0	41·3	31·5	68·2	1·7	23·5	47·3	27·5	10410	0·52	1·521	Cw	3
	bottom	190	1416/61‡	..	..	74·9	18·9	11·6	40·3	13·5	69·2	1·5	26·6	49·8	22·1	11860	0·47	1·456	Cm	6
		Mine Sections—																		
Riverside No. 2	top	M/R2t/1	320/59*	..	..	..	..	..	..	..	..	2·0	22·3	34·0	41·7	7780	0·50	1·662	..	..
	top	M/R2t/2	321/59*	..	..	..	..	..	..	..	..	2·1	23·2	36·7	38·0	8420	0·54	1·612	..	..
	bottom	M/R2b/1	322/59*	..	..	..	..	..	..	..	..	2·1	21·9	30·9	45·1	7326	0·49	1·709	..	..
	bottom	M/R2b/2	323/59*	..	..	..	..	..	..	..	..	2·1	23·1	35·0	39·8	8170	0·43	1·639	..	..
	bottom	M/R2b/3	925/61‡	..	..	65·6	17·9	10·1	42·7	24·3	75·1	1·8	26·3	50·7	21·2	11530	0·54	1·439	Cw/Cm	5

* Washability not tested; analysis on original sample.
† Washability tests at S.G. 1·4, 1·54 and 1·71.
‡ Washability tests at S.G. 1·6 and 1·8 only.

APPENDIX I

Fossil Plants from Borehole N.S. 231, between pors. 22 and 91, par. Moggill, at depths of 530-540 ft.

By J. T. Woods, M.Sc.,
Supervising Geologist (Palaeontology)

Collector: D. C. Mengel.

Determinations:

	Specimens
Dicroidium odontopteroides	36
Dicroidium coriaceum	16
Ctenis sp.	6
Xylopteris elongata	3
Doratophyllum tenison-woodsi	3
Czekanowskia tenuifolia	3
Xylopteris spinifolia	2
? Fraxinopsis sp.	2
Yabeiella brackebuschiana	2
Neocalamites carreri	1
Neocalamites sp.	1
? Neuropteridium sp.	1
Cladophlebis johnstoni	1
Rienitsia lobata	1
Linguifolium sp.	1

Age:

Tivoli Formation, Ipswich Coal Measures, Middle Triassic.

Remarks:

Species of *Dicroidium* are the dominant elements of the collection, with *D. odontopteroides* comprising 46 per cent of the whole, and *D. coriaceum* 20 per cent. The latter species is here interpreted to include the complete range of forms referred to *Johnstonia coriacea, J. dentata* and *J. trilobita* by Jones and de Jersey (1947), from the Ipswich Coal Measures. The apparent gradation of the three species was noted by these authors, and examination of a large number of specimens, from the present collection as well as from another locality in the Moggill area, shows the variation to be such that subdivision into the three species is impracticable. The preponderance of deeply dentate leaves (= *J. dentata* and *J. trilobita*) suggests an age equivalent to part of the Tivoli Formation. The presence of *Linguifolium* sp. and *Cladophlebis johnstoni* supports this view.

Specimens of *Xylopteris* (= *Stenopteris*) are rare in the collection and of these the fronds referred to *X. spinifolia* are very simply bipinnate forms. Their evidence of age, based on the evolutionary scheme of Jones and de Jersey (1947), is in keeping with that proposed above.

In the borehole, Riverside No. 2 seam occurs at a depth of 273 ft. 11½ in. to 298 ft. 3¼ in. and Riverside No. 3 seam at a depth of 376 ft. 0½ in. to 394 ft. 11½ in.

In the eastern part of the Moggill area a plant collection consisting of abundant specimens of *Dicroidium coriaceum,* associated with *Ctenis* sp. was made by V. R. Forbes from siliceous shales in a gully in por. 128, par. Moggill, about 10 chains north of the junction of Livesay Road and Prior's Pocket Road.

REFERENCE

Jones, O. A., and de Jersey, N. J., 1947: The flora of the Ipswich Coal Measures—Morphology and floral succession. *Univ. Qld Dep. Geol. Pap. 3(3).*

APPENDIX II

Report on Fossil Plants from Borehole N.S. 240, Moggill

By J. T. Woods, M.Sc.,
Supervising Geologist (Palaeontology)

Locality: Borehole N.S. 240, 7 chains E. of SW. corner of por. 92, par. Moggill.

Collector: I. B. Freytag.

Determinations (in relation to coal seams):

Ft.	In.	Ft.	In.		No. of Specimens
80	0	— (?)		Riverside No. 1 seam	
97	4	— 99	4	*Czekanowskia tenuifolia*	2
				Doratophyllum tenison-woodsi	1
				Ginkgoites ipsviciensis	1
105	1½	—117	2½	Riverside No. 1A seam	
131	9	—195	9¾	Riverside No. 1B seam	
233	3	—239	10¼	Riverside No. 2 seam (tops)	
262	0	—281	4	*Dicroidium coriaceum*	4
				Czekanowskia tenuifolia	2
				Dicroidium odontopteroides	1
				Rienitsia lobata	1
				Xylopteris elongata	1
284	1¾	—289	5	Riverside No. 2 seam (bottoms)	
301	4	—310	10	Indeterminate plant fragments	
310	10	—319	10	*Czekanowskia tenuifolia*	1
				Dicroidium odontopteroides	1
339	4	—347	4	*Neocalamites carreri*	1
347	4	—353	4	*Dicroidium odontopteroides*	1
360	7½	—370	4	*Cladophlebis* sp.	1
379	7	—389	7	*Neocalamites carreri*	2
389	7	—399	5	*Neocalamites carreri*	1
402	11	—422	1	Riverside No. 3 seam	
493	3	—505	3	*Dicroidium odontopteroides* var. *lancifolium*	9
				Dicroidium odontopteroides var. *acutum*	4
				Ctenis sp.	1

Age: Probably Tivoli Formation, Ipswich Coal Measures, Middle Triassic.

Remarks: Eleven species are represented in this collection of 35 specimens, and, of these, nine range throughout the greater part of the Ipswich Coal Measures. Of the stratigraphically restricted forms, *Dicroidium coriaceum,* which is present in the collection from 260 ft. 0 in. to 281 ft. 4 in., is of common occurrence in the Tivoli Formation, but Jones and de Jersey (1947) also list one occurrence in the Cooneana

Formation from 50 ft. below the Rob Roy seam. However, the occurrence of *Ctenis* sp. in the collection from 493 ft. 3 in. to 505 ft. 3 in. lends weight to a suggestion that at least the lower half of the section in borehole N.S. 240 may be equivalent to part of the Tivoli Formation. *Ctenis* sp. is close to the form recorded by Jones and de Jersey (1947) from sediments of this formation at Sandy Creek, par. Chuwar.

In the Moggill area, *Dicroidium coriaceum*, in association with *Ctenis* sp., has been recorded from a surface outcrop in por. 128, par. Moggill, and in N.S. 231, in a collection from 530 ft. to 540 ft. (Woods, 1961). The latter occurrence is approximately 150 ft. below Riverside No. 3 seam.

REFERENCES

JONES, O. A., and DE JERSEY, N. J., 1947: The flora of the Ipswich Coal Measures—Morphology and floral succession. *Univ. Qld Dep. Geol. Pap. 3* (*3*).

WOODS, J. T., 1961: Fossil plants from borehole N.S. 231, between pors. 22 and 91, par. Moggill, at depths of 530-540 ft. Unpub. rep. Geol. Surv. Qld.

S. G. REID, Government Printer, Brisbane

LOCALITY MAP

SCALE OF MILES

2½ 2 1½ 1 ½ 0 2½

200W 00 200E 400E

400N 200N 00 200S

HAIGHMOOR AREA
ABERMAIN R.HAIGH AREA
MORETON EXT. AREA
WESTFALEN AREA
MOGGILL AREA
BRISBANE RIVER
Bremer River
Dinmore
Riverview
Redbank
Ebbw Vale
Bundamba
Booval
IPSWICH
East Ipswich
BUNDAMBA AREA
NEW WHITWOOD AREA
NEW ABERDARE EAST AREA
COONEANA ESTATE AREA
RHONDDA AREA
BOX FLAT AREA
BLACKHEATH
BONNIE DUNDEE AREA
SWANBANK LAGOON AREA
SOUTHERN CROSS AREA
NEW HOPE AREA

T.N

BREMER R.

RIVERVIEW
DINMORE
LOCKYER
DARLING
DOWNS Creek
REDBANK
HIGHWAY
Six Mile
Moggill Ferry

151 150 148 112 111 149 149A 110 109 108 147 107 105 106 102 104 101 C.M.L. 100 103 359 98 97 99 96 94 95 93 22 217 R 489 91 R 488 192 92 90 89 87 88 86 85 83 84

2000N. 2000S. 4000S. 4000E. 6000E. 8000E.

FIG. 2

BRISBANE RIVER

LOCALITY MAP
MOGGILL MINE AREA
Scale of Chains

15 0 15 30 45

N.J.H.

FIG.2

dark coloured clays

dark coloured clays

wh. f. ss. below soil cover

ss cliffs

ss & sh.

Dam

No.4 Trial Shaft

MOGGILL
(Formerly Riverside No.2)

Airshaft

Alluvium

ss

ss

Prospect Tnl

ss cliffs

N.S.233
R.L.Coll. 74·59
R.L.Surf. 73·09

N.S.234
R.L.Coll. 77·44
R.L.Surf. 75·94

N.S.232
R.L.Coll. 70·09
R.L.Surf. 68·59

N.S.235
R.L.Coll. 76·27
R.L.Surf. 74·77

N.S.223
R.L.Coll. 54·29
R.L.Surf. 51·79

RIVERSIDE No.3 A

RIVERSIDE No.1 A

ROAD

RIVER

Bore(P)o

Airshaft

N.S.190
R.L.Coll 67·52
R.L.Surf. 65·95

N.S.230/231
R.L.Coll. 77·22
R.L.Surf. 75·72

N.S.225/227
R.L.Coll. 58·31
R.L.Surf. 57·06

N.S.228
R.L.Coll. 59·10
R.L.Surf. 57·10

N.S.237
R.L.Coll. 67·21
R.L.Surf 65·71

N.S.240
R.L.Coll. 57·30
R.L.Surf. 55·80

R 489

R.488

BRISBANE

MOGGILL

2000N

2000S

4000S

2000W

2000E

4000E

97 98 99 94 96 95 93 192 92 91 90 89 88 87 22

A A′ B B′ C C′

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

MOGGILL MINE AREA
IPSWICH COALFIELD

Parish of Moggill
County of Stanley
Showing topography & boreholes
To accompany report by I.B.Freytag B.Sc. Geologist
Topographical Survey by E.Cowley

Scale of Chains

5 0 5 10 15

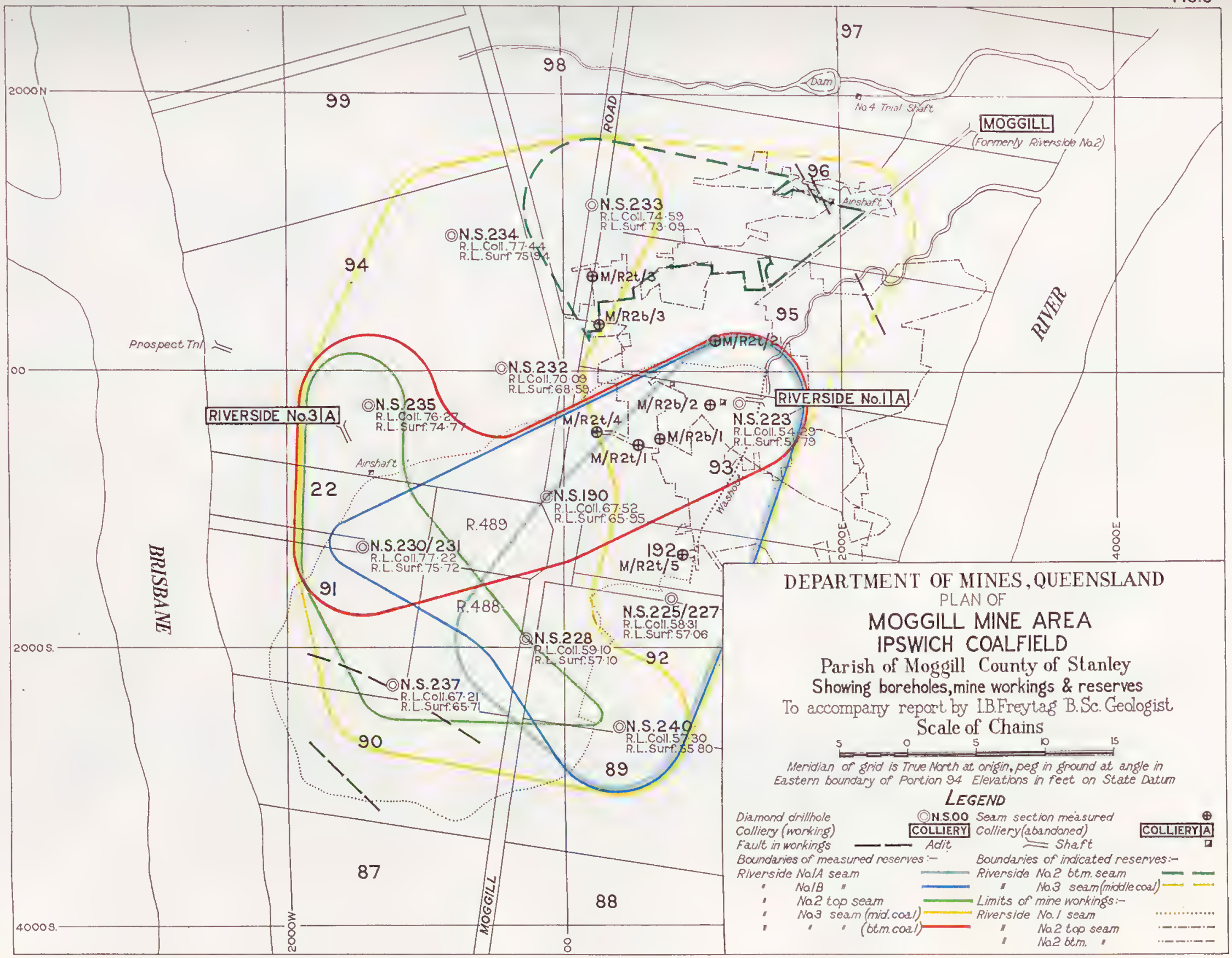
Meridian of grid is True North at origin, peg in ground at angle in Eastern boundary of Portion 94. Elevations in feet on State Datum

LEGEND

Diamond Drillhole	◎N.S.00	Surface Contours	70
Section Line	A——A′	Outcrop	
Colliery (working)	COLLIERY	Colliery (abandoned)	COLLIERY A
Adit		Shaft	

N.J.Hunt

FIG.3



DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

MOGGILL MINE AREA
IPSWICH COALFIELD

Parish of Moggill County of Stanley

Showing boreholes, mine workings & reserves

To accompany report by I.B.Freytag B.Sc. Geologist

Scale of Chains

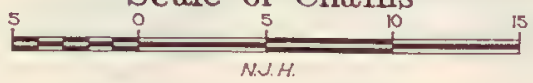
5 0 5 10 15

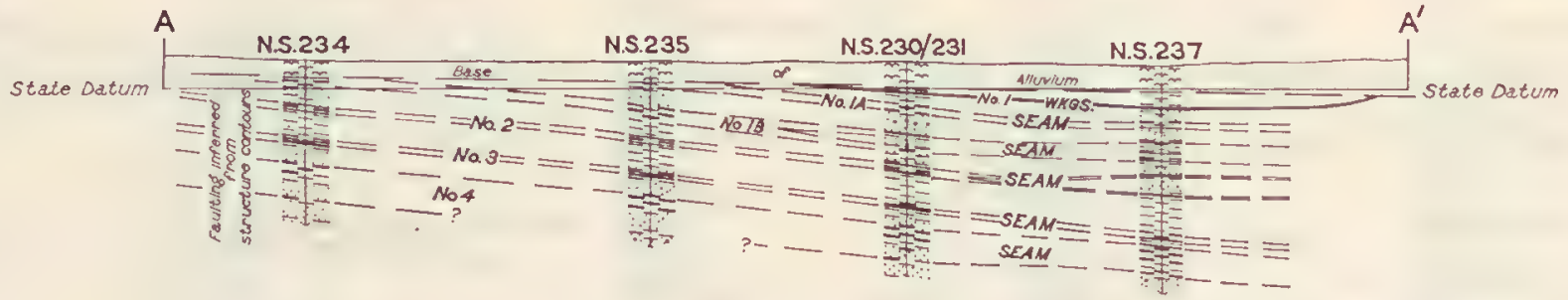
Meridian of grid is True North at origin, peg in ground at angle in Eastern boundary of Portion 94 Elevations in feet on State Datum

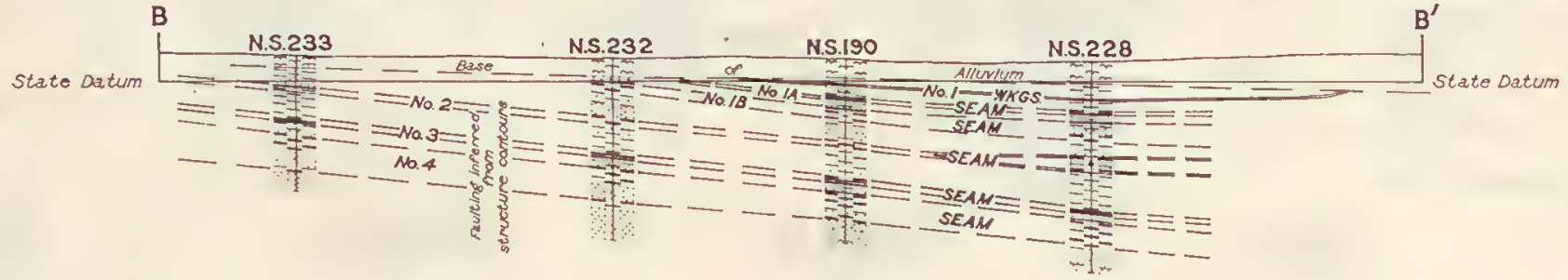
LEGEND

- Diamond drillhole — ◎N.S.00
- Colliery (working) — COLLIERY
- Fault in workings — Adit
- Seam section measured — ⊕
- Colliery (abandoned) — COLLIERY A
- Shaft
- Boundaries of measured reserves:–
  - Riverside No.1A seam
  - " No.1B "
  - " No.2 top seam
  - " No.3 seam (mid. coal)
  - " " " (btm. coal)
- Boundaries of indicated reserves:–
  - Riverside No.2 btm. seam
  - " No.3 seam (middle coal)
- Limits of mine workings:–
  - Riverside No.1 seam
  - " No.2 top seam
  - " No.2 btm. "

MOGGILL MINE AREA
CROSS SECTIONS
Scale of Chains







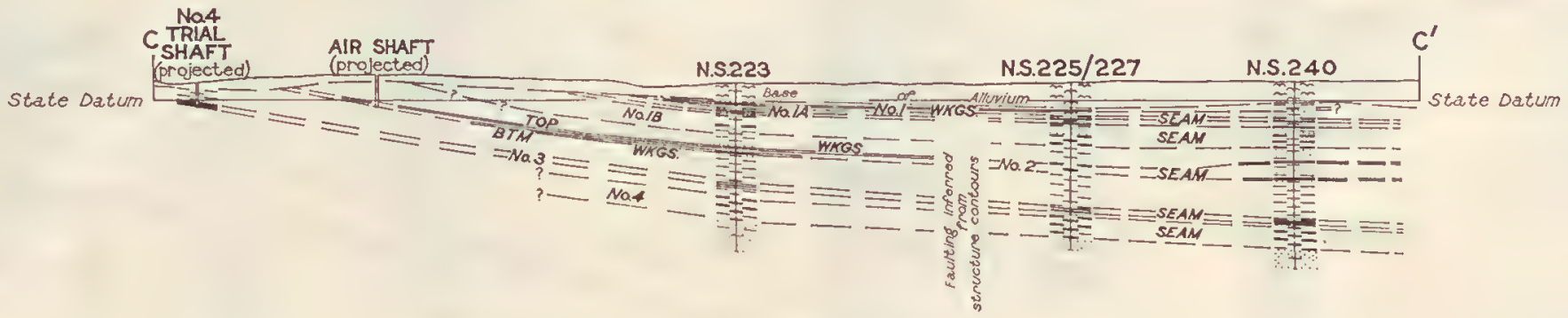


FIG. 6

MOGGILL MINE AREA—DETAILED SEAM SECTIONS

RIVERSIDE No. 1A SEAM

N.S.190

Analysis	Recovery per cent	Section Sampled	Description
		107′3″	dk. gy. sh. 1½″ carb. sh. ½″ dk. gy. sh. ¼″ carb. sh. 2¾″ gy. sh. 2″ carb. sh. 2″ gy. sh. 1½″ carb. sh. 3″ coal 1″ wh. med. ss. 3″ gy. sh. 1″ inf. coal ¼″ d. gy. sh. 1¼″ coal ½″ inf. coal ½″ carb. sh. ½″ bluey 7″ fwn. sh. ½″ carb. sh. ¼″ coal ¾″ carb. sh. 3″ coal 2″ fwn. sh. 3¼″ coal 1″ carb. sh. ¼″ coal ¾″ fwn. sh. 1″ bluey 1½″ fwn. sh. ¾″ bluey 2″ carb. sh. 1½″ fwn. sh. 3¼″ coal 3¼″ fwn. sh. 1¼″ coal ¾″ carb. sh. 1¾″ fwn. sh. 8½″ coal ½″ fwn. sh. 2″ carb. sh. 1¾″ coal ½″ fwn. sh. ½″ carb. sh. 2″ coal 1″ carb. sh. 4¾″ fwn. sh. 1¼″ carb. sh. 1″ coal 1½″ carb. sh. 1″ coal ¾″ carb. sh. 3½″ d. gy. sh 2½″ gy. slts. 2½″ fwn. sh. 2½″ gy. slts. ½″ carb. sh. 3¼″ coal ¾″ carb. sh. ½″ 1. gy. sh 1¾″ carb. sh. 2″ 1. gy. sh. 2½″ carb. sh. 1¾″ fwn. sh. ½″ carb. sh. 2¼″ fwn. sh 1¼″ bluey
A% 20·9	99·31	1739/58	
		117′4½″	¾″ gy. sh. ½″ carb. sh. 5½″ coal 1¼″ carb. sh. → inf. coal 1½″ coal ¾″ bluey 2′2½″ coal
		120′4″	¾″ carb. sh. gy. sh.

N.S.223

Analysis	Recovery per cent	Section Sampled	Description
		71′8½″	d. gy. sh. 3½″ carb. sh. ½″ inf. coal ¾″ carb. sh. ½″ coal 1″ carb. sh. → inf. coal 3″ coal ¾″ inf. coal ¼″ br. sh. 2½″ coal 3½″ br. sh. 2″ carb. sh. 1½″ brn. sh. 3½″ coal ½″ inf. coal ½″ crmy. sh. 4½″ coal 1″ l. br. sh. 4″ d. gy. sh. ¾″ crmy. sh. 2″ inf. coal 2″ l. fwn. sh. 4″ coal 2″ l. fwn. sh. 1¼″ coal 1″ carb. sh. ½″ inf. coal 2¼″ l. fwn. sh 1″ carb. sh. 3″ coal 3″ fwn. sh. 11″ inf. coal 1½″ carb. sh. ½″ fwn. sh. 1″ coal ¾″ carb. sh. 2″ coal 1″ inf. coal 4″ fwn. sh. 1″ inf. coal ¾″ carb. sh. 2″ inf. coal 1¼″ d. gy. sh. 4″ br. sh. 3¼″ crmy. sh. 2¼″ carb. sh. 1″ coal
A% 30·7			
S.G. 1·537			
Wash at S.G. 1·8* 91 25		189/61	
Discard 43·3			
A% of floats 15·0			
		80′9½″	2½″ carb. sh. 1″ br. sh 3″ carb. sh ½″ carb. sh. ¾″ br. sh. 4½″ coal 1″ gy. sh. 5″ coal 2″ inf. coal 8″ coal ¾″ gy. sh. ¾″ coal ½″ gy. sh 7½″ coal ¾″ carb. sh 4″ coal ¼″ gy. sh
		85′9½″	1′2½″ coal d. gy. sh

N.S.227

Analysis	Recovery per cent	Section Sampled	Description
		98′1″	gy. slts ¾″ inf. coal 3¾″ gy. sh. 1″ coal 4″ d. gy. sh. 3″ carb. sh. ½″ coal 2¼″ fwn. sh.
		99′10½″	3¾″ d. gy. sh. 1″ carb. sh. 1½″ coal ¼″ br. sh. 1¼″ carb. sh 1¼″ inf. coal 1″ carb. sh. ¼″ coal 3½″ fwn. sh. ½″ carb. sh. 1″ fn. sh. ½″ carb. sh. 1″ br. sh. 5″ coal 2″ bluey 4½″ coal 2″ br. sh. 1½″ coal ¾″ br. sh. ¼″ carb. sh. 5″ coal & inf. coal ¾″ carb. sh. 6″ coal 1½″ gy. sh. 1½″ fwn. sh. 1″ cry. sh 1″ carb. sh. ¼″ br. sh 2½″ coal 1½″ d. gy. sh. ½″ coal 7¼″ gy. sh. 4″ carb. sh. 1″ fwn. sh. ½″ carb. sh 1″ inf. coal ¼″ br. sh 4½″ coal 1½″ fn. sh. 1½″ coal & inf. coal ¼″ br. sh. 1″ carb. sh. 1¾″ coal ¾″ carb. sh. 1¾″ coal 1¼″ bluey ½″ carb. sh ½″ br. sh 1½″ fn. sh 1¼″ bluey
A% 44·1			
S.G. 1·702			
Wash at S.G. 1·8* 82·13		196/61	
Discard 34·0			
A% of floats 22·4			
A% 73·3		} Excl.	1′10½″ coal
S.G. 2·210			
		110′10″	3½″ inf. coal 1″ boulder 1½″ clay in st. gy. sh

N.S.228

Analysis	Recovery per cent	Section Sampled	Description
		136′10½″	d. gy. sh. 2½″ carb. sh 5″ gy. sh 1¾″ fwn. sh. 3″ carb. sh
		139′10¼″	1′0″ dk. gy. sh. 1″ wh. f. ss. ¾″ d. gy. sh. 1″ gy. sh 2¼″ dk. gy. sh. 2½″ fwn. sh. ½″ carb. sh. 1″ inf. coal → coal ¼″ d. gy. sh. 1½″ coal. 2¾″ fwn. sh 1¼″ coal 4½″ inf. coal ½″ carb. sh 1″ gy. sh. 1″ carb. sh. 1″ br. sh. ½″ carb. sh. 1″ carb. sh. 2″ d. gy. sh. ½″ inf. coal 1¼″ carb. sh. 3″ inf. coal ½″ carb. sh
A% 45·4			
S.G. 1·701			
Wash at S.G. 1·8*			
Discard 47·4	79 55	517/61	
A% of floats 28·0			
A% 82·8		} Excl.	8″ inf. coal 1¼″ carb. sh. 4½″ 1. fwn. sh. 1¼″ inf. coal 1½″ d. gy. sh.
S.G. 2·502			
		144′5¼″	¾″ coal ¾″ gy. sh. 4″ d. gy. sh. 1′1¼″ gy. sh.
A% 80·1	100	519/61	
S.G. 2·352			
		146′1¾″	2½″ carb. sh. 2″ coal 1¾″ carb. sh 3½″ gy. sh. 1¾″ carb. sh 1½″ coal ¾″ 1. gy. slts. 3″ coal 3″ carb. sh.
A% 32·8			
S.G. 1·559			
Wash at S.G. 1·8*	96 62	520/61	
Discard 24·8			
A% of floats 18·7			
		149′10″	1′1¾″ coal, ½″ gy. sh at 2½″ & 1″ bluey at 4½″ 2¾″ bluey 9″ coal 2½″ carb. sh. dk. gy. sh.

N.S.237

Analysis	Recovery per cent	Section Sampled	Description
		150′10¾″	gy. sh. 1″ carb. sh. ½″ fwn. sh ¾″ d. gy. sh. ½″ carb. sh. ½″ d. gy. sh ¾″ fwn. sh. ¾″ gy. sh ½″ carb. sh 1″ d. gy. sh. 2″ coal 1″ d. gy. sh. 1″ fwn. sh. ¾″ coal
		152′6¼″	½″ inf. coal 1¼″ fwn. sh 2¾″ inf. coal gy. sh
Not to Scale			
		157′3″	fwn. sh. & gy. slts. 4¼″ carb. sh 1½″ fwn. sh 5″ coal 1″ fwn. sh. ¾″ carb. sh. ½″ coal 1½″ fwn. sh 2″ coal 2¼″ carb. sh ¾″ fwn. sh 1½″ carb. sh. 5¼″ coal 1¾″ fwn. sh. 1¾″ gy. sh. 1¾″ carb. sh 1¼″ fwn. sh. 3½″ inf. coal 1½″ carb. sh ½″ coal 2½″ inf. coal ½″ dk. gy. sh. 7½″ coal ¾″ dk. gy. sh. 6½″ fwn. sh 2¾″ dk. gy. sh. 4″ dk. gy. slts 1′6½″ l. gy. slts 2½″ carb. sh 3¼″ gy. sh. 1¼″ l. fwn. sh. 2¼″ gy. sh. 1¾″ carb. sh. 2¾″ dk. gy. sh. 7¼″ l. gy. sh. 8¾″ gy. sh.
A% 27·1			
S.G. 1·491			
Wash at S.G. 1·8*	98 45	909/61	
Discard 12·6			
A% of floats 21·2			
		166′5¾″	4″ coal 3″ carb. sh. 1″ coal ¾″ gy. sh 1′2″ coal
		169′2″	2″ carb. sh. 7″ coal 2″ carb. sh gy. sh

N.S.240

Analysis	Recovery per cent	Section Sampled	Description
		105′1½″	d. gy. slts. 2½″ inf. coal 5¾″ l. gy. sh 1″ coal 1½″ fwn. sh. 1½″ inf. coal 3½″ gy. sh 2¼″ wh. slts. 1½″ gy. slts 6″ fwn. sh ¼″ carb. sh. ½″ coal 1¼″ carb. sh 1″ coal 1¼″ fwn. sh 1″ inf. coal 2½″ coal 1½″ carb. sh ½″ inf. coal 1½″ fwn. sh. 2½″ coal 1¼″ l. gy. sh 1¼″ coal ¾″ fwn. sh 3½″ coal 1¼″ d. gy. sh ¼″ coal 2″ inf. coal 1¼″ l. gy. sh. 4¼″ coal ½″ gy. sh 2¼″ coal 1¼″ gy. sh. 2½″ fwn. sh. 1″ d. gy. sh. 3½″ inf. coal & carb. sh. 5″ coal 1¾″ d. gy. sh. 1″ fwn. sh. ¾″ inf. coal ¾″ carb. sh. 2″ gy. slts 1¼″ inf. coal 1¾″ coal 1¼″ carb. sh. 1¼″ gy. sh 3½″ coal ¾″ gy. sh ¾″ coal 1½″ carb. sh. 3″ coal 1¼″ carb. sh. 1″ gy. sh. ¼″ coal 1¾″ fwn. sh 11½″ coal ¾″ carb. sh
A% 26·8		Excl.	
S.G. 1·494			
Wash of S.G. 1·8* 99 57		918/61	
Discard 16·3			
A% of floats 17·3			
		112′4″	1′4″ coal, ½″ gy. sh at 5¼″ & 1″ inf. at 7½″ ½″ gy. sh. 3½″ bluey
		117′2″	6¼″ coal ½″ carb. sh. gy. sh.

* for washability see Table I

MOGGILL MINE AREA-DETAILED SEAM SECTIONS

RIVERSIDE No.1B SEAM

N.S.190

Analysis	Recovery per cent	Section Sampled
A% 27·7	76·61	1740/58

142′0″ wh. med. ss.
3″ coal ¾″ carb. sh
3″ coal ½″ carb. sh.
6½″ coal & carb. sh.
¾″ f.n.sh. 2½″ coal
½″ f.n.sh. 4″ coal
¾″ f.n.sh
10½″ coal
145′6¾″
8″ f.n. sh.
¾″ inf. coal 4½″ coal
1½″ carb. sh.
3¼″ f.n.sh. ¾″ coal ¾″ f.n.sh.
4″ coal
147′10¾″ 1¾″ carb. sh. ½″ coal 2¼″ carb. sh.
l.gy.sh.

N.S.223

Analysis	Recovery per cent	Section Sampled
A% 27·5 S.G. 1·505 Wash at S.G. 1·8*	84·62	190/61
Discard 33·5 A% of floats 10·0		

91′5½″ d.gy.sh.
2′10½″ coal with ¼″ f.n.sh. at 5″ & 1½″ br.sh. between 1′0″ & 2′1½″
94′11¾″ 1½″ boulder
7¼″ f.n.sh.
1¼″ coal 1¼″ gy.sh.
4½″ coal with ¼″ f.n.sh. at ¾″
¾″ carb.sh 2¾″ f.n.sh 2″ coal
¼″ l.br.sh. 1⅞″ carb.sh & inf. coal
¾″ coal 1¼″ carb.sh.
10½″ gy.sh.
3½″ br.sh
½″ carb.sh. 1″ coal
5″ inf. coal
7″ coal
99′9″ 3″ gy.s/ts d.gy.sh.

N.S.227

Analysis	Recovery per cent	Section Sampled
A% 26·7 S.G. 1·502 Wash at S.G. 1·8* Discard 17·7 A% of floats 15·7	100	198/61
A% 73·2 S.G. 2·211 } Excl.		

121′3″ wh. f. ss.
1′0½″ coal
¾″ f.n.sh
6½″ coal
1″ d.gy.sh.
3½″ coal
5″ f.n.sh. ¾″ d.gy.sh.
9″ coal with inf. coal & bluey
½″ d.gy.sh. ½″ coal
2¼″ d.gy.sh.
7″ l.f.n.sh. 1¼″ d.gy.sh.
1¼″ coal 1″ d.gy.sh. ½″ carb.sh
″ coal 7″ carb.sh. → d.gy.sh.
125′3″
127′0½″ l.gy.sh.

N.S.228

Analysis	Recovery per cent	Section Sampled
A% 28·3 S.G. 1·506 Wash at S.G. 1·8* Discard 24·7 A% of floats 13·6	90·28	521/61
A% 82·3 S.G. 2·397 } Excl.		

171′8″ wh. med. ss.
5¼″ coal
¾″ br.sh.
10″ coal
2″ f.n.sh.
8″ coal
¾″ gy.sh.
8¼″ coal with some inf. coal
3″ l.gy.sh.
½″ carb.sh ½″ coal 2″ d.gy.sh.
3¾″ coal ¼″ d.gy.sh.
2⅛″ inf. coal 2⅛″ coal
½″ d.gy.sh. 1¾″ coal ¾″ d.gy.sh.
1¼″ coal
177′8″ 1″ d.gy.sh. 1½″ coal
d.gy.sh.

N.S.231

Analysis	Recovery per cent	Section Sampled
A% 34·8 S.G. 1·553 Wash at S.G. 1·8* Discard 24·9 A% of floats 21·5	100	649/61
A% 84·3 S.G. 2·448 } Excl.		
A% 85·8 S.G. 2·479 } Excl.		

191′6½″ gy.–wh. f. ss
5¼″ coal with some inf. coal
1½″ gy.sh.
7¼″ coal
¾″ d.gy.sh.
10″ coal
9″ l.gy.sh
2½″ carb.sh → d.gy.sh
¼″ coal ¾″ d.gy.sh. ½″ coal ½″ d.gy.sh.
5½″ coal
½″ gy.sh 1¼″ coal 1½″ gy.sh. 2½″ f.n.sh.
2″ inf. coal with ¼″ gy.sh. 1″ gy.sh.
7¼″ coal
197′0¾″ ½″ l.br.sh. 2″ coal ¼″ d.gy.sh. 1⅛″ inf. coal
d.gy.sh.

N.S.232

Analysis	Recovery per cent	Section Sampled
A% 25·9 S.G. 1·481 Wash at S.G. 1·8* Discard 23·9 A% of floats 14·5	82·83	657/61

72′11½″ wh. med. ss.
1¼″ coal ½″ d.gy.sh.
6½″ coal
½″ gy.sh
5¾″ coal with ¼″ l.gy.sh.
¾″ gy.sh.
6½″ coal
75′4¼″
5¾″ f.n.sh.
½″ inf. coal 1″ gy.sh. 1″ carb.sh. ½″ gy.sh
¾″ carb.sh. ¼″ gy.sh. ½″ coal 3¼″ f.n.sh
4″ coal
¾″ carb.sh. ¾″ coal ¼″ carb.sh.
6½″ f.n.sh.
1¼″ carb.sh. ¼″ br.sh.
2¾″ coal ½″ inf. coal
78′3¼″ l.gy.sh.

N.S.237

Analysis	Recovery per cent	Section Sampled
A% 30·3 S.G. 1·557 Wash at S.G. 1·8* Discard 25·9 A% of floats 14·9	81·70	919/61
A% 82·3 S.G. 2·429 } Excl.		

206′5¾″ wh. f. ss.
½″ coal 1½″ br.sh
5″ coal ½″ d.gy.sh
2¼″ coal ¼″ l.gy.sh. 1¾″ carb.sh.
6¼″ coal
¾″ d.gy.sh.
11¼″ l.gy.s/ts.
1′0¾″ f.n.sh.
1½″ carb.sh 2″ gy.sh. ½″ carb.sh. ½″ gy.sh
¼″ carb.sh. ¼″ gy.sh 3¾″ coal
¾″ carb.sh ¼″ coal 1½″ d.gy.sh.
3″ l.f.n.sh. 2¼″ inf. coal ¼″ d.gy.sh.
2½″ l.f.n.sh. ½″ carb.sh 1¼″ coal
¾″ carb.sh. ¾″ gy.sh. 2¼″ coal
3½″ carb.sh. ½″ l.br.sh. ¼″ inf. coal
1½″ carb.sh. 1″ gy.sh. ¼″ carb.sh.
213′0½″ ¾″ coal 3″ carb.sh.
gy.s/ts.

N.S.240

Analysis	Recovery per cent	Section Sampled
A% 30·3 S.G. 1·557 Wash at S.G. 1·8* Discard 25·9 A% of floats 14·9	81·70	919/61
A% 82·3 S.G. 2·429 } Excl.		

131′9″ gy.s/ts.
10½″ coal with ¼″ gy.sh. at 1½″ & ½″ gy.sh. at 7¼″
¾″ gy.sh.
5¼″ coal 1″ inf. coal
3½″ coal ½″ d.gy.sh.
4¾″ coal ½″ carb.sh.
6¾″ l.gy.sh.
5¾″ coal
2″ inf. coal 3″ coal with ¼″ gy.sh.
1½″ inf. coal
4¼″ l.gy.–f.n.sh
3½″ carb.sh. ¾″ gy.sh. 1¼″ coal
1¼″ gy.sh. ¼″ carb.sh. ¼″ gy.sh. 1″ carb.sh.
136′5″
137′10½″ 1″ gy.sh. 3½″ carb.sh.
gy.sh.

* for washability see Table I

MOGGILL MINE AREA – DETAILED SEAM SECTIONS

RIVERSIDE No. 2 SEAM

N.S.228

Analysis	Recovery per cent	Section Sampled
A% 27·4 S.G 1·488 Wash at S.G 1·8* 93·78 Discard 15·8 A% of floats 17·6		523/61

269′9″ wh f ss.
1¾″ carb.sh
3″ coal
1½″ f.n.sh 5½″ coal
½″ f.n.sh

1′8¼″ coal with ¼″ carb.sh.

272′9¼″ 3¼″ f.n.sh 1″ coal 1¾″ gy.sh
¼″ carb.sh 2¾″ inf coal ½″ coal
1½″ l.br.sh ½″ inf coal ¼″ carb.sh
2½″ coal ¼″ carb.sh 1″ d.gy.sh.
1½″ inf coal ½″ inconst. 1½″ carb.sh
1″ d.gy.sh ½″ coal 1½″ carb.sh
2″ d.gy.sh. ½″ l.gy.sh. 3″ carb.sh
6½″ coal

276′3¾″ 1¾″ d.gy.sh 1″ inf. coal

d.gy.sh

Not to scale

gy. sh.

309′4¼″ 1¾″ carb.sh. 1″ coal ½″ f.n.sh
3½″ coal

1′3½″ carb.sh with few f.n.sh bands

1¼″ bluey
6½″ coal
¾″ carb.sh 2″ coal
4½″ f.n.sh. 1¼″ carb.sh.
3″ coal
6½″ carb.sh with ½″ gy.sh at 2″ & coal bands
1″ gy.sh. 1¼″ carb.sh. 1¼″ d.gy.sh
1½″ carb.sh. 1½″ gy.sh 3½″ coal with ½″
carb.sh. 1½″ f.n.sh.
8½″ coal
1½″ f.n.sh.
3¾″ coal 1¾″ carb.sh
1½″ gy.sh ¼″ carb.sh. ½″ coal
8½″ gy.sh

315′10″

N.S.231

Analysis	Recovery per cent	Section Sampled
A% 39·7 S.G. 1·611 Wash at S.G. 1·8* 97·00 Discard 29·5 A% of floats 24·4		652/61

273′1½″ wh. f.ss.
½″ bluey 1″ carb.sh. 2½″ inf. coal
7½″ coal
¾″ f.n.sh. ¾″ coal ¾″ carb.sh.
2¼″ coal 1¼″ d.gy.sh
2½″ coal 2¼″ gy.sh
1¾″ coal ½″ f.n.sh
6½″ coal
½″ l.gy.sh. 4″ coal
½″ d.gy.sh.
6¾″ coal with 1″ inf. coal
½″ d.gy.sh. 3¼″ coal

278′1½″ 3¾″ f.n.sh. 2¼″ carb.sh
2¼″ f.n.sh.
4½″ carb.sh
2¼″ d.gy.sh. ¾″ f.n.sh. 1½″ carb.sh.
½″ d.gy.sh 3″ inf. coal 3″ carb.sh
2½″ f.n.sh.
3¾″ carb.sh. ½″ d.gy.sh.
2″ coal 1″ boulder 1½″ inf. coal ¼″ gy.sh
1¼″ carb.sh. ¼″ coal 5½″ carb.sh
3¼″ inf coal
1½″ carb.sh 3½″ coal

282′8¾″ 1¼″ bluey 3″ carb.sh.

gy.sh

Not to scale

gy.sh.

292′1½″ 1¾″ f.n.sh. ¾″ carb.sh 1″ f.n.sh.
¼″ carb.sh. 1″ coal 1″ carb.sh.
1¼″ f.n.sh. 2½″ carb.sh. 2½″ coal
1″ f.n.sh. 2″ carb.sh. 1″ coal 1″ inf coal
¾″ carb.sh.
4¼″ coal
½″ f.n.sh. ¾″ coal ¾″ f.n.sh. ¼″ inf. coal
2″ f.n.sh. 1¾″ carb.sh.
3¼″ inf coal & carb.sh.
1″ f.n.sh. ½″ carb.sh. 1½″ inf. coal
4″ carb.sh

6″ coal
1″ carb.sh. ½″ f.n.sh. 1¼″ coal
2″ carb.sh.

298′3¼″ 1¼″ coal ½″ gy.sh. ¾″ carb.sh.

l.gy.sh.

N.S.232

Analysis	Recovery per cent	Section Sampled
A% 42·5 S.G 1·667 Wash at S.G 1·8* 100 Discard 30·6 A% of floats 30·0		1410/61
A% 82·8 S.G 2·420 Excl.		

170′8″ wh f-med ss 3¾″ f.n.sh.
2¼″ carb.sh. 2¼″ f.n.sh
1¼″ inf. coal 1″ carb.sh. 1″ inf. coal
5½″ crmy.sh.
1¾″ carb.sh. 1¾″ l.br.sh.
7″ carb.sh.

9″ f.n.sh.
2¼″ wh. co. ss.
8¼″ f.n.sh.
¾″ carb.sh. 2″ wh f.ss.
3″ carb.sh. 1¼″ bluey
5½″ carb.sh
2¼″ f.n.sh. 1¼″ carb.sh. ½″ br.sh

7¼″ bluey
4¾″ inf. coal
½″ d.gy.sh. 3½″ carb.sh.
6½″ coal
3″ carb.sh. 2½″ f.n.sh.

178′6″ l.g.slts.

Not to scale

l.g.sh

181′11″ 10¼″ carb.sh with ¾″ f.n.sh.

1½″ gy.sh
9″ carb.sh
4½″ coal – inf. coal
½″ carb.sh. 1″ coal ¾″ carb.sh.
¾″ f.n.sh. 4¼″ d.gy.sh. 2¼″ f.n.sh.
2″ carb.sh.
3″ l.gy.sh. 2″ carb.sh
1″ l.gy.sh.
4¾″ coal ¾″ f.n.sh. 1¾″ coal
¾″ d.gy.sh. 1″ f.n.sh.
8″ d.gy.sh
2¼″ f.n.sh. 3″ carb.sh

187′6¼″ 7¼″ coal
1″ carb.sh. ¾″ coal ¾″ f.n.sh. 1¼″ carb.
sh. 6¾″ coal – inf. coal in places
¾″ l.gy.sh. ½″ carb.sh. ½″ coal ½″ carb.sh.
1¼″ d.gy.sh. 3″ f.n.sh. ¾″ carb.sh 1″ coal
5¼″ f.n.sh
4½″ inf. coal – coal
½″ d.gy.sh. 2″ inf. coal ½″ carb.sh.
½″ inf. coal 1¼″ f.n.sh. ½″ carb.sh 2″ coal
½″ carb.sh 1″ coal ½″ carb.sh. 1¼″ gy.sh.

191′ ½″ 6½″ coal
½″ carb.sh ½″ f.n.sh. 2″ carb.sh
1″ l.gy.sh ¼″ inf. coal 1¼″ coal ½″ carb.sh
l.gy.sh

N.S.233

Analysis	Recovery per cent	Section Sampled
A% 40·0 S.G. 1·613 Wash at S.G. 1·8* 85·55 Discard 23·3 A% of floats 27·6		661/61
A% 40·3 S.G 1·638 Wash at S.G. 1·8* 97·19 Discard 34·4 A% of floats 22·6	A% 81·4 S.G 2·408 Excl.	662/61

89′2½″ wh med.ss.
1″ inf. coal ¼″ f.n.sh. 1½″ carb.sh
1¾″ inf coal 1″ d.gy.sh.
6½″ coal
1½″ f.n.sh.
1½″ coal 2¼″ carb.sh ¾″ d.gy.sh
4″ coal 2″ carb.sh.
1″ inf coal
3½″ coal ¾″ inf coal
4″ coal

92′8″ 1″ carb.sh 1¾″ coal
3″ f.n.sh ¼″ carb.sh 1½″ gy.sh
2½″ carb.sh 1¾″ f.n.sh. ½″ inf. coal
½″ d.gy.sh. ½″ coal ¾″ carb.sh 1¼″ coal
1¾″ carb.sh. 2¼″ l.f.n.sh. 1¼″ carb.sh
¾″ f.n.sh 4½″ coal & inf. coal
1¼″ carb.sh. 3¼″ l.f.n.sh. 1½″ carb.sh.
¼″ f.n.sh. 1½″ inf. coal
5″ bluey
4″ inf. coal 1½″ coal
2″ inf. coal 2¼″ carb.sh. ½″ d.gy.sh.
1¾″ carb.sh
8″ inf. coal
1″ f.n.sh 1″ carb.sh 1½″ d.gy.sh.
3″ carb.sh
4¼″ coal
4½″ carb.sh. 1½″ coal
6½″ carb.sh

5¼″ coal
1¼″ gy.sh. 1¼″ inf. coal
3¾″ d.gy.sh.
2¾″ f.n.sh.
1½″ carb.sh. 1″ f.n.sh.
5¼″ coal ½″ gy.sh.
1½″ coal

102′8″ 3½″ d.gy.sh. 1½″ l.f.n.sh. 1½″ d.gy.sh.
½″ carb.sh. ¼″ l.f.n.sh ½″ carb.sh.
2½″ inf. coal 2¼″ carb.sh
5¼″ coal
½″ f.n.sh. 1½″ d.gy.sh 1½″ inf. coal 1½″
carb.sh. ½″ f.n.sh. 1″ inf. coal 4″ f.n.sh
2½″ coal
1″ carb.sh. 1″ inf. coal ½″ f.n.sh.
2¼″ coal ½″ buff. sh. 1¾″ bluey
½″ gy.sh ½″ carb.sh. 1½″ coal ½″ gy.sh.
2″ f.n.sh.
8¼″ coal 1″ f.n.sh.

1′3″ coal

107′10¼″ d.gy.sh.

* for washability see Table 1

MOGGILL MINE AREA—DETAILED SEAM SECTIONS

RIVERSIDE No.2 SEAM

N.S.234

Analysis	Recovery per cent		Section Sampled
A% 47·2 S.G. 1·575	100		893/61
A% 45·2 S.G. 1·708 Wash at S.G. 1·8* 33·7 Discard A% of floats 29·0	A% 83·8 S.G. 2·456 } Excl. 98·47		894/61

118′8½″ 6″ wh f ss
5″ coal
¾″ l gy sh 1½″ coal ¼″ br sh 1½″ inf coal ¼″ br. sh. 1½″ coal ½″ fn. sh.
3¼″ carb. sh. 2″ coal ¾″ carb. sh. ¼″ d. gy. sh. 1¾″ coal 1¼″ l. gy. sh. 3¾″ coal
120′11¾″ 2½″ carb. sh. 2¼″ fn. sh.
¾″ inf. coal 3¾″ carb. sh.
1¼″ bluey
3¾″ carb. sh ½″ coal ¾″ br sh
5½″ inf coal with 1¼″ carb sh
½″ coal ½″ carb sh. 3″ coal
¼″ carb sh 3¾″ l fn sh
3¾″ carb sh. ¼″ fn sh ½″ carb sh
2¾″ coal ½″ carb sh 1″ coal
1″ carb. sh. 3½″ fn sh. 1″ carb. sh.
1½″ inf coal
5¼″ carb. sh ½″ coal
6½″ carb sh
½″ d gy sh 3¾″ coal
¾″ d gy sh 3¾″ coal
½″ carb sh ½″ l fwn sh. 1½″ coal ½″ gy sh.
4″ carb. sh 1⁄8″ inf coal ¾″ carb. sh
1¼″ d gy sh. 1″ carb sh. ½″ d gy sh ¾″ carb sh ¾″ gy. sh. 1½″ carb. sh 2″ d gy sh.
2″ carb. sh. ½″ coal 1½″ carb sh
7½″ l fn sh.
2¼″ carb sh
5¾″ d gy sh
½″ coal 1″ carb sh.
3¼″ fwn sh 1″ inf coal ¾″ carb sh
3″ fwn sh
1½″ carb sh ¾″ fn sh 2½″ coal
3¾″ carb. sh ½″ l fn sh 1⅛″ coal
2″ d gy sh 1½″ fwn sh 2½″ d gy sh ¾″ br sh. 1″ d gy sh. 1″ fn sh. ½″ d. gy sh.
132′0½″ 1″ carb sh. 3″ coal 1½″ carb. sh. with ½″ fn sh. ½″ coal 2½″ inf. coal
4½″ coal ½″ carb sh ¾″ gy sh
¼″ coal 2″ carb sh 2¼″ coal
2¼″ carb. sh ¾″ coal ¼″ fn sh
1½″ carb. sh. 3½″ l. fn. sh
5″ coal
½″ d gy. sh ½″ coal 1½″ carb. sh. ½″ inf. coal 1¼″ br. sh. 1″ carb. sh. 2″ coal
1½″ gy. sh. 4″ coal 1″ inf. coal
½″ carb. sh. 2″ coal ¾″ l fn sh
½″ d gy. sh. 2″ inf. coal
5½″ coal
137′1″ 1″ l. gy. sh. 1¾″ coal ¼″ carb. sh l. fn. sh.

N.S.235

Analysis	Recovery per cent		Section Sampled
A% 42·7 S.G. 1·653 Wash at S.G. 1·8* 30·4 Discard A% of floats 24·3	94·42		901/61
A% 39·5 S.G. 1·638 Wash at S.G. 1·8* 34·3 Discard A% of floats 22·1	A% 83·6 S.G. 2·517 } Excl. 94·41		902/61

200′8¼″ 1¾″ wh ss
3″ carb sh
6½″ coal with ¼″ carb sh
1¾″ l gy sh 1¼″ coal ¼″ gy sh 1¼″ inf coal 2″ carb sh ¾″ d gy sh
¾″ coal 2″ fwn sh
1½″ coal ¼″ carb sh ½″ fn sh
¾″ coal ¾″ fn sh. ½″ carb. sh
2½″ coal 1″ carb. sh 1½″ coal ¾″ carb sh
2″ coal 1¼″ carb. sh
2½″ coal 1¼″ inf. coal 1¼″ coal
204′5½″ 3¾″ fn sh
2″ inf coal ½″ carb. sh 1″ fn sh 1½″ carb sh 1¾″ fn sh
2″ carb sh. ½″ fn sh.
4¼″ inf coal 1¼″ carb. sh. 1½″ coal
1¾″ carb. sh. 1½″ fn sh
3¼″ carb. sh.
9¾″ coal 2″ carb sh
3¼″ fn sh
5¼″ carb. sh.
3″ coal 1″ carb sh. 1½″ coal
1″ inf coal 1½″ carb sh. 1″ coal ¼″ fn sh
1¼″ inf coal ½″ coal ¾″ gy sh ½″ carb sh 2½″ inf coal ¾″ coal ¾″ carb. sh
3″ fwn sh 2″ carb sh. ¾″ fn sh.
3½″ carb sh 2″ coal
3″ carb sh. 1¼″ fn sh
6¼″ carb. sh.
3¾″ inf coal ¼″ carb sh
½″ d gy sh ½″ carb. sh
3¼″ d gy sh. 1¼″ fn sh
2½″ d gy. sh. 2¾″ fn. sh. 1″ carb. sh
1¾″ fn sh. 1¾″ carb sh. 1¾″ fn sh
6¾″ coal
3¼″ carb sh
2½″ fn slts. 2¼″ carb sh ¼″ d gy sh
214′6″ 2¼″ fn sh ¾″ carb sh ¾″ fn sh
1″ carb sh ¼″ fn sh 3″ coal
4″ inf coal ½″ carb sh 1″ inf coal
1″ fn sh. ¾″ inf coal
1½″ coal 5½″ inf. coal
¾″ fn sh 1¼″ inf. coal ½″ carb. sh
4¾″ l fn sh
5″ inf coal ½″ gy sh ¼″ carb sh
2½″ inf coal 1¼″ fn. sh. 1¼″ carb. sh.
¼″ coal ½″ gy sh ¼″ carb sh. ¼″ coal.
½″ carb sh 1″ gy. sh 4¾″ coal with ¼″ fn. sh. 2″ fn sh. with ½″ carb sh
9½″ coal
½″ fn sh
5″ coal
220′1″ 1¾″ carb sh
gy sh

N.S.237

Analysis	Recovery per cent		Section Sampled
A% 29·1 S.G. 1·500 Wash at S.G. 1·8* 22·1 Discard A% of floats 17·5	95·34		910/61
A% 41·8 S.G. 1·661 Wash at S.G. 1·8* 34·5 Discard A% of floats 22·6	A% 83·6 S.G. 2·503 } Excl. 97·92		911/61

289′10½″ ss.
3″ bluey
4½″ coal
1¼″ gy sh 5¼″ coal
¼″ gy sh.
8½″ coal with ¾″ bluey
½″ gy. sh.
7½″ coal
¼″ carb sh ¼″ gy sh
293′0″ 3½″ coal ½″ d gy sh
3¾″ l gy sh
2¼″ carb. sh 1″ d gy sh ½″ coal
1½″ carb sh ¼″ gy sh ½″ carb. sh ½″ gy sh
3″ coal 2¼″ carb sh
2″ inf. coal 3¼″ carb sh
½″ gy sh 1½″ carb sh. 1″ inf coal ¼″ carb sh ¼″ l gy sh. ½″ carb sh 2¾″ gy sh.
1½″ carb sh 3½″ d gy sh
2¼″ coal ¼″ gy sh 2″ carb. sh.
¼″ gy sh 1¼″ inf coal ¼″ gy sh.
297′5″ 7″ coal
d g sh

Not to scale

d g sh
341′6¾″ ¾″ inf. coal ½″ coal 1″ gy. slts.
3¼″ coal
1″ fn sh. 2″ d gy sh.
342′10¼″ 2½″ fn. sh. ½″ d gy. sh.
4¼″ coal 1″ bluey
4″ coal ¼″ carb. sh. ½″ gy. sh.
¾″ carb. sh. ½″ coal 5¼″ fn sh
¼″ carb sh 2″ inf. coal
5¼″ coal with ¼″ fn sh.
½″ carb. sh. 3″ coal
1½″ fn sh 1¼″ carb. sh. 2″ coal with ¼″ fn sh. 1″ gy sh. 1″ fn. sh. 1¼″ inf. coal
1¾″ coal ¼″ fn sh. 1″ inf. coal
346′10¼″ 2¼″ coal 2¼″ fn. sh. 3″ coal
gy. sh.

N.S.240

Analysis	Recovery per cent		Section Sampled
A% 32·0 S.G. 1·538 Wash at S.G. 1·8* 29·1 Discard A% of floats 24·4	80·88		921/61

gy. slts.
2½″ wh. f. ss.
233′3″ 5″ coal with ¾″ fn sh & ¾″ d g sh
½″ fn sh.
1′0½″ coal with ¾″ bluey at 4¼″
2″ inf. coal 3¼″ coal
2″ fn sh. 2¼″ coal
236′1″ ¾″ carb. sh. 1″ d gy sh. 1¼″ fn. sh.
3″ carb. sh. ½″ coal ½″ carb sh
2¾″ br sh. 1½″ carb. sh 1½″ coal ½″ br. sh
1″ inf coal 1¼″ d gy sh. 3½″ fn sh
½″ carb sh. 2″ inf coal ¾″ carb sh
½″ coal 1¼″ d gy sh. 3″ coal
2¾″ fn sh ¼″ coal ½″ carb. sh.
1½″ inf. coal 2½″ coal 1½″ carb. sh
6¾″ coal
239′10¼″ ½″ carb. sh. 1½″ coal
d g sh

Not to scale

wh. med. ss.
284′1¾″ ¾″ d g sh.
10″ coal with ½″ fn. sh.
1½″ inf. coal 1½″ carb. sh.
1½″ d gy sh. 2½″ fn. sh.
6¼″ d gy sh. ½″ gy. slts.
1¼″ d gy. sh. 1″ inf. coal 1½″ gy. sh.
4″ coal
1″ carb. sh. 2″ coal ¼″ d gy. sh.
1¾″ inf. coal 2¼″ carb. sh.
1¼″ d gy. sh. 1¼″ carb. sh. ¾″ gy. sh. ½″ carb. slts. 1″ coal 1″ carb. sh. 1¼″ gy. slts.
7¼″ coal
1¼″ fn sh
289′5″ 4″ coal ½″ carb. sh. ¾″ gy. sh. ¼″ coal
1½″ gy. slts.
gy sh

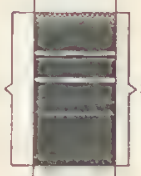
* for washability see Table I

MOGGILL MINE AREA—COLLIERY SECTIONS

RIVERSIDE No.2 SEAM

M/R2t/1

Analysis: A% 41·7 — Section Sampled: 320/59



3'8"

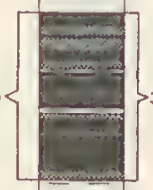
Roof:- wh. ss

¾" inf. coal ¼" gy. sh. 2¼" bluey→inf. coal
¾" gy. sh. 7" coal
1" brn-fwn. sh. 1" coal ½" brn.-fwn. sh.
5" coal 1¼" brn.-fwn. sh.
5½" coal ¾" brn. sh.
2" coal 1½" bluey
11" coal→inf. in parts
1½" bluey 2" coal

Floor:- fwn. sh.

M/R2t/2

Analysis: A% 38·0 — Section Sampled: 321/59



3'11½"

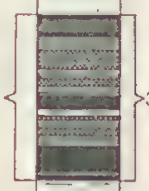
Roof:- ss

3½" coal
2" inf. coal 1" bluey ¾" coal
3¾" bluey 5" coal→inf. coal
1" gy. sh. ½" bluey ¾" coal ½" gy. sh
1¼" coal ¾" bluey 1½" coal→inf. 1¼" bluey
½" carb. sh. 3" coal 1½" fwn. sh. 1½" inf. coal
→coal ¼" fwn. sh 4" coal→inf. in places
¾" fwn. sh. 4¾" coal ¼" gy. sh. ½" coal
¾" bluey ¼" fwn. sh. 5¼" coal 2¾" bluey

Floor:- fwn. sh.

M/R2t/3

Not sampled



3'11¾"

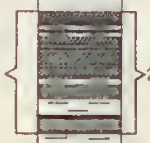
Roof:- f. ss.

2¼" coal 1¾" inf. coal ½" carb. sh.
1¾" coal 3½" carb. sh.
5¾" inf. coal
1¼" fwn. sh. ¾" carb. sh. ½" fwn. sh.
1¼" inf. coal ¼" fwn. sh. 1" inf. coal 1½" carb.
sh. ¼" coal ½" fwn. sh. ¼" coal ¼" fwn. sh.
3½" coal 1¾" fwn. sh. 1½" inf. coal ¼" fwn. sh.
1¼" carb. sh. ½" gy. sh. 2¼" inf. coal ½" fwn. sh.
2½" carb. sh. 1½" coal ¼" fwn. sh. 5½" coal
1" carb. sh. 1¼" coal

Floor:- fwn. sh.

M/R2t/4

Not sampled



2'10½"

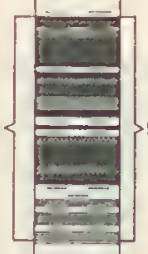
Roof:- ss.

1" bluey ¼" brn. sh. 2¾" coal
1½" fwn. sh. ¾" coal 1" fwn. sh. 1¾" bluey
¼" fwn. sh. ½" coal ½" fwn. sh. ¾" inf. coal
½" fwn. sh. 3½" bluey ¾" fwn. sh. 2¾"
bluey ½" carb. sh.
1½" fwn. sh. 4" carb. sh. 4¾" fwn. sh.
1" coal ¼" fwn. sh. 4" carb. sh.

Floor:- fwn. sh.

M/R2t/5

Not sampled



5'3"

Roof:- dk gy. sh.

3" coal 1" fwn. sh. 1½" carb. sh.
1" coal ¼" gy. sh. 2" coal ¼" gy. sh
2½" coal ¼" fwn. sh. 1¾" coal
1¾" l. gy. sh. 1¾" coal ¼" fwn. sh. 1½"
bluey 3¼" coal ¼" fwn. sh. 3¾" carb. sh
1¾" coal 2¾" l. fwn. sh. 1" coal
2" l. fwn. sh. 1¼" inf. coal ½" carb. sh.
5½" coal
3" inf. coal 2½" coal
4¼" l. fwn. sh. 2" carb. sh.
1¾" l. fwn. sh. 3½" carb. sh. 2" fwn. sh.
2" carb. sh. ¼" fwn. sh.

Floor:- carb. sh.

M/R2b/1

Analysis: A% 45·1 — Section Sampled: 322/59

4'11"

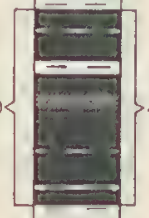
Roof:- gy. sh.

2¼" bluey 4" coal
7½" bluey→inf. coal
½" gy. sh. 1¾" bluey
3½" fwn. sh. 3½" bluey
3" coal 1½" inf. coal ½" gy. sh.
2½" bluey 1¼" fwn. sh.
4½" bluey→inf. coal 1" gy. sh.
5" coal ¼" fwn. sh. 1" inf. coal 1¼" l. gy. sh.
10¾" coal
1½" gy. sh. 2" coal

Floor:- fwn. sh.

M/R2b/2

Analysis: A% 39·8 — Section Sampled: 323/59



4'6½"

Roof:- gy. sh.

5½" coal 1" fwn. sh.
¾" coal ¼" fwn. sh. 7" coal
4" fwn. sh.
½" bluey 5" coal
4½" bluey
3" coal ½" fwn. sh.
7½" coal
1" fwn. sh
9" coal
1½" fwn. sh 3½" coal

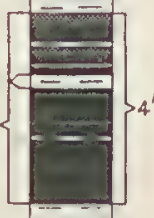
Floor:- fwn. sh.

M/R2b/3

Analysis: A% 33·9 — S.G 1·572 — Wash at S.G 1·8* — Discard % 24·3 — A% of floats 21·2

Section Sampled: 925/61

A% 83·3 — S.G. 2·503 } Excl.



4'5"

Roof:- fwn. sh.

1" bluey ¼" fwn. sh. 3" bluey
3½" coal 1½" fwn. sh.
2½" bluey 2¼" coal
1" bluey→carb. sh. 2" coal 4" fwn. sh.
9" coal
¾" l. fwn. sh. 1¼" coal ¼" fwn. sh. 2"
coal 1¼" fwn. sh.
6½" coal ¼" fwn. sh 1" coal
½" fwn. sh.
3¼" coal

Floor:- sh

* for washability see Table I

FIG. 9A

MOGGILL MINE AREA–DETAILED SEAM SECTIONS

RIVERSIDE No. 3 SEAM

N.S.190

Analysis	Recovery per cent		Section Sampled
A% 31·0 S.G. 1·553 Wash at S.G. 1·8*		93·45	1412/61
Discard % 18·3 A% of floats 23·5			Excl.
			Excl.
A% 53·9 S.G. 1·863		92·52	1413/61
A% 42·9 S.G. 1·704 Wash at S.G. 1·8* Discard % 31·5 A% of floats 27·5		95·27	1414/61
A% 81·2 S.G. 2·462			Excl.
A% 27·9 S.G. 1·516 Wash at S.G. 1·8* Discard % 13·5 A% of floats 22·1		89·32	1416/61

335′2¾″ d.gy.sh.
¼″ bluey ½″ m.gy.sh. ¼″ bluey
3″ carb.sh.
1¾″ l.gy.sh.
7″ br.sh
1½″ m.gy.sh 2″ bluey
4½″ coal
¾″ br.sh. ¾″ carb.sh. 1½″ coal with ½″ sh
4¼″ bluey 1¼″ f.n.sh
1″ carb.sh. 5″ br.–carb.sh.
1″ m.gy.sh ⅛″ carb.sh. ¾″ br.sh.
1¼″ bluey 1″ coal 1½″ bluey ½″ br.sh.
1½″ bluey 1½″ coal 2″ br.sh.
2¼″ carb.sh. 1″ coal 2¼″ br.sh.

11″ bluey
3″ f.n.sh.

341′7¼″ ¾″ bluey ½″ f.n.sh ½″ coal 2″ l.gy.sh.
½″ carb.sh. 1¾″ coal 1″ bluey
4″ coal 2½″ bluey
½″ coal ½″ m.gy.sh.
7½″ coal
½″ carb.sh ½″ f.n.sh ¾″ v.inf. coal
2″ br.sh.
4¼″ coal ½″ f.n.sh.
6¾″ coal
½″ f.n.sh ½″ carb.sh ½″ f.n.sh ¼″ carb.sh ¾″

345′5″ coal 1″ f.n.sh ¾″ carb.sh. 5⅛″ coal
½″ l.gy.sh. 2½″ bluey ½″ coal
2″ f.n.sh 3″ bluey
2½″ f.n.sh. ¼″ coal ½″ br.sh ½″ bluey
¾″ f.n.sh. 4½″ bluey
1″ f.n.sh 1″ inf. coal ½″ f.n.sh. 1″ carb.sh.

347′7¾″ ¾″ coal 2″ carb.sh 1″ f.n.sh. ¾″ coal
3″ bluey
3½″ coal 1″ f.n.sh. ¼″ carb.sh 2¾″ coal
1½″ carb.sh 2¼″ f.n.sh
3″ carb.sh
5½″ coal
1¾″ bluey ¼″ f.n.sh. 2″ coal ¾″ f.n.sh.
½″ carb.sh ½″ f.n.sh. 3″ bluey
2″ coal ½″ d.gy.sh. 1½″ coal

351′2″ 2½″ gy.sh. 1½″ bluey
1½″ coal 2″ bluey
6″ coal
¾″ carb.sh.
10″ coal
½″ carb.sh ¾″ d.gy.sh.
2¾″ bluey 1½″ carb.sh.

1′2½″ coal, some carb.sh. in btm. 3½″

355′0½″ d.gy.sh.

N.S.223

Analysis	Recovery per cent		Section Sampled
A% 53·4 S.G. 1·890 Wash at S.G. 1·8* Discard % 68·4 A% of floats 19·8		90·81	191/61
A% 46·8 S.G. 1·737 Wash at S.G. 1·8* Discard % 61·4 A% of floats 20·5		97·49	192/61
A% 30·8 S.G. 1·533 Wash at S.G. 1·8* Discard % 37·5 A% of floats 14·8		91·84	193/61

291′7″ gy.sh.
3″ coal 2″ carb.sh.
2½″ gy.sh. 1½″ l.gy.silts
3¼″ d.gy.sh. 1″ f.n.silts
1½″ coal 1″ carb.sh. 2″ coal 1″ bluey
1½″ carb.sh
7½″ gy.sh
1″ carb.silts. 1½″ f.n.sh. ¾″ carb.sh.
2″ coal ½″ carb.sh. 1¾″ d.gy.sh.
3¼″ carb.sh. with inf. coal
2½″ l.gy.silts 1″ carb.sh ½″ br.sh.
1″ carb.sh ¾″ gy.silts. 1¾″ carb.sh.
1″ gy.sh ¾″ coal 3¼″ carb.sh ½″ d.gy.sh
2¾″ carb.sh. 2¾″ gy.sh. 2″ carb.sh.
1¾″ coal 2″ gy.sh. ¾″ carb.sh.
½″ coal 1″ carb.sh. 1″ coal 1″ inf. coal
5⅛″ bluey → carb.sh.
3″ f.n.sh.
1¼″ carb.sh. 1½″ f.n.sh. 1¾″ carb.sh.
3¼″ coal ¾″ carb.sh. ¼″ f.n.sh. ½″ inf.

298′11″ coal 1″ carb.sh. ½″ gy.sh. ¾″ inf. coal ½″ gy.sh. ½″ carb.sh. 2″ coal ¾″ gy.sh
7″ coal with ¼″ f.n.sh
½″ f.n.sh. 1″ coal 2¾″ l.f.n.sh.

6½″ coal with two ¼″ f.n.sh bands
½″ f.n.sh. 1½″ coal ½″ br.sh.
1½″ coal 1½″ l.f.n.silts. 1″ coal ½″ gy.sh.
5¼″ coal
2¼″ bluey ¾″ gy.sh. ¾″ coal
2″ f.n.sh. ½″ coal 1¼″ carb.sh. ¼″ coal
2″ f.n.sh. ¾″ carb.sh. ¾″ coal ½″ f.n.sh.
2″ carb. with ¾″ f.n.sh. ¾″ coal 1¼″ bluey
½″ coal ¾″ m.sh. 1½″ carb.sh. ½″ f.n.sh.

304′4¼″ ½″ bluey 3¾″ carb.sh. ¼″ l.gy.silts.
¾″ inf. coal 1″ coal 2″ carb.sh.
3½″ coal 1″ l.gy.sh. ½″ carb.sh.
2¼″ inf. coal 2″ carb.sh
2½″ buff silts. 2¼″ carb.sh.
1¼″ coal ½″ carb.sh. 1″ coal 2″ carb.sh.
1½″ coal 1½″ carb.sh. 1″ coal ¾″ d.gy.sh.
1½″ coal ½″ gy.sh. 1¼″ carb.sh ¾″ coal
½″ gy.sh. 1¼″ carb.sh. 3″ coal

307′8″ 2″ f.n.sh.
2″ inf. coal 2″ bluey 2½″ v.inf. coal
4¾″ coal with ¼″ br.sh.
¾″ gy.sh.
10¾″ coal with two ¼″ f.n.sh bands
1¾″ bluey 1″ d.gy.sh 1″ carb.sh

1′6½″ coal

311′9″ gy.sh.

N.S.225

Analysis	Recovery per cent		Section Sampled
A% 52·8 S.G. 1·840 Wash at S.G. 1·8* Discard % 52·3 A% of floats 26·3		88·19	195/61
A% 47·9 S.G. 1·746 Wash at S.G. 1·8* Discard % 49·4 A% of floats 29·2		100	514/61
A% 73·9 S.G. 2·403		100	515/61
A% 44·7 S.G. 1·736 Wash at S.G. 1·8* Discard % 59·3 A% of floats 23·8		100	516/61

368′2″ d.gy.sh
2″ carb.sh.
2″ inf. coal ¼″ carb.sh.

369′1¼″ 1¾″ d.gy.sh. 4¼″ carb.sh with ¼″ gy.sh
½″ coal 1½″ carb.sh. ½″ coal
2½″ l.gy.sh
5¼″ carb.sh.
1″ inf. coal 4¼″ carb.sh with ½″ d.gy.sh.
1″ bluey 2″ d.gy.sh
2″ carb.sh. 2¼″ gy.sh
4½″ inf. coal ½″ carb.sh.
1″ coal 6″ bluey

3″ f.n.sh
2″ carb.sh. 1¾″ gy.sh.
3″ carb.sh ¼″ coal 1½″ carb.sh.
½″ bluey

1′1¼″ coal

375′1¾″ ½″ d.gy.sh. 1″ inf. coal
3″ f.n.sh. 1¼″ inf. coal 1″ coal 1¼″ carb.sh ½″ crmy.sh 6½″ coal
½″ carb.sh ½″ gy.sh ½″ crmy.sh ¾″
carb.sh ¾″ f.n.sh 1¼″ coal 1¼″ f.n.sh.
¾″ carb.sh 1½″ coal 3″ inf. coal
¼″ carb.sh 4″ coal
1¾″ f.n.sh ¾″ carb.sh 1¾″ bluey
2½″ f.n.sh ¾″ carb.sh 2¾″ coal ¼″
carb.sh 1″ f.n.sh 2¾″ bluey ½″ carb.sh
½″ coal ½″ f.n.sh 1″ carb.sh 1″ f.n.sh.

379′8½″ 6½″ carb.sh. ¾″ f.n.sh
5¼″ inf. coal
1″ f.n.sh. ¾″ inf. coal
1¼″ carb.sh. 1¼″ f.n.sh. 2¾″ carb.sh.
2″ coal 2½″ carb.sh.
½″ inf. coal 1″ f.n.sh. 2″ carb.sh. ¾″ l.
f.n.sh. 1″ carb.sh. 2½″ inf. coal ¼″ f.n.sh.

382′3¾″ 1¼″ carb.sh. 2¾″ coal

382′8¾″ 3¼″ f.n.sh. 1¼″ carb.sh.
1½″ coal 1″ bluey ¾″ inf. coal ¼″ gy.sh.
1″ carb.sh. 5½″ coal with ½″ gy.sh at 2¾″
¼″ f.n.sh. ½″ bluey ¾″ carb.sh. 1″ coal ¼″
carb.sh. 1¼″ bluey ¾″ f.n.sh. 5½″ coal
1″ f.n.sh. 1½″ bluey
8½″ coal

1¼″ carb.sh. 1¼″ coal

385′1½″ 1¼″ d.gy.sh. 1½″ inf. coal 2″ carb.sh.
gy.sh.

N.S.228

Analysis	Recovery per cent		Section Sampled
A% 38·1 S.G. 1·618 Wash at S.G. 1·8* Discard % 33·7 A% of floats 23·1		100	524/61
A% 44·6 S.G. 1·729 Wash at S.G. 1·8* Discard % 37·1 A% of floats 29·5		99·40	525/61
A% 65·0 S.G. 2·223		94·74	526/61
A% 44·9 S.G. 1·718 Wash at S.G. 1·8* Discard % 40·0 A% of floats 26·2		96·25	527/61

415′4½″ d.gy.sh.
8″ carb.sh
3″ inf. coal
1½″ carb.sh.
1½″ d.gy.sh. 6¼″ l.gy.sh.
¾″ inf. coal 1½″ d.gy.sh.
3″ coal 1¼″ carb.sh.
2″ coal ½″ d.gy.sh. 1¼″ carb.sh.
5½″ l.f.n.sh.

11″ carb.sh → bluey
1″ gy.sh
3¾″ carb.sh 2½″ gy.sh
4″ carb.sh → bluey
2″ coal 3½″ carb.sh.
½″ coal 3¼″ f.n.sh
1″ carb.sh. 1″ gy.sh. ½″ carb.sh. 1″ f.n.sh.

421′10¾″ 1½″ carb.sh. 1″ coal 3¾″ carb.sh.
¾″ l.gy.sh. 1¼″ coal 3½″ carb.sh.

1′2″ coal & some inf. coal

¼″ carb.sh. 1″ gy.sh. ½″ inf. coal 2″ f.n.sh
1¼″ coal ¾″ inf. coal ½″ d.gy.sh. ½″ coal
1½″ carb.sh. ¼″ coal ¾″ f.n.sh. 5″ coal

425′0″ ¾″ carb.sh. 1″ inf. coal ½″ l.br.sh.
1½″ carb.sh. 2¼″ boulder
1¾″ l.f.n.sh.
6″ inf. coal → coal in places
4¼″ carb.sh. 1¼″ coal
2½″ gy.sh. ½″ carb.sh. 2½″ f.n.sh.
1¼″ carb.sh. 1¼″ coal
5¼″ carb.sh with ¾″ f.n.sh at 1½″

427′1½″ ¾″ f.n.sh. 1¾″ carb.sh. 1″ f.n.sh 1½″ carb.sh. 1¼″ inf. coal 1¾″ carb.sh. ¾″ f.n.sh
¾″ carb.sh. 4¾″ bluey
1¾″ coal ¾″ gy.sh. 2½″ inf. coal → coal
1½″ carb.sh. 1¼″ inf. coal 1¾″ d.gy.sh.
¾″ carb.sh. 2¼″ coal ½″ carb.sh.
2″ inf. coal ¼″ carb.sh. ¾″ coal 1¼″ carb.sh ½″ gy.sh. ¾″ carb.sh. ¾″ f.n.sh. ½″ carb.sh. 1½″ bluey 2¾″ coal 1½″ carb.sh.

431′5″ ½″ f.n.sh ½″ coal ½″ bluey ¾″ carb.sh.
1½″ coal 1″ bluey 1¼″ coal 2½″ f.n.sh

432′2½″ 2½″ lst. ¼″ f.n.sh. 1¼″ coal 2½″ carb.sh.
4″ coal 1½″ f.n.sh.
3″ coal 1″ f.n.sh. 1″ inf. coal
1¾″ coal 2¼″ carb.sh.
2½″ coal 2″ clay ironst.
2″ coal 2¼″ inf. coal

7½″ coal
½″ gy.sh ¼″ coal 1″ gy.sh. 2″ coal
9″ gy.sh ½″ coal ½″ f.n.sh

435′6½″ 1½″ carb.sh 1¼″ coal ¾″ carb.sh.
¾″ d.gy.sh. l.gy.silts.

* for washability see Table I

MOGGILL MINE AREA—DETAILED SEAM SECTIONS

RIVERSIDE No. 3 SEAM

N.S.231

Analysis	Recovery per cent		Section Sampled
A% 42·1			
S.G. 1·678			
Wash at S.G. 1·8*	98·47		653/61
Discard % 33·5			
A% of floats 25·9			
	A% 84·6		Excl.
	S.G. 2·498		
A% 45·2			
S.G. 1·738			
Wash at S.G. 1·8*	100		655/61
Discard % 45·7			
A% of floats 27·3			
A% 40·6			
S.G. 1·685			
Wash at S.G. 1·8*	100		656/61
Discard % 39·4			
A% of floats 22·9			

376′0½″ 9″ gy sh.
7″ carb sh, ½″ coal, ¾″ carb sh
1″ coal, ¼″ carb sh, ¾″ fn sh
3″ coal
8¾″ fn sh
1¾″ carb sh, 1¾″ fn sh
1″ carb sh, ½″ coal, 3½″ carb sh
½″ inf coal, ¾″ br sh, 1¼″ carb sh
½″ l br sh, 2¼″ carb sh
3½″ fn sh
5″ carb sh
¾″ inf coal, 1¼″ carb sh, ½″ coal, ¼″ carb sh, ½″ l br sh, 2¼″ carb sh, 2″ l br sh
3″ carb sh, 2½″ inf coal
2¾″ fn sh, 2¼″ bluey 1″ coal
7½″ bluey
2¾″ fn sh, ¾″ carb sh, 1¾″ fn sh.
383′0¼″ ½″ carb sh, ½″ l br sh.
3½″ bluey, ¾″ coal
1½″ inf coal, ½″ fn sh, 1¼″ coal
2¼″ bluey, 3¾″ coal, ½″ fn sh
10″ coal with two ¼″ sh. bands
2¾″ fn sh
2″ coal, ¼″ carb sh, ¼″ fn sh, ¾″ inf coal
½″ l br sh, 4½″ coal, ½″ carb sh, 1¾″ v. inf coal, ¾″ carb sh, 1¼″ coal, ½″ carb sh
1½″ gy–fn sh, 2″ coal, ½″ fn sh, 2″ inf coal
387′1″ 1¾″ coal, ¾″ inf coal, 1″ fn sh.
2¼″ inf coal
1″ fn sh, 1″ bluey
6¼″ coal, ¾″ fn sh.
4½″ coal
1″ gy sh, 1¾″ inf coal, ½″ l gy sh, ½″ carb. sh, 2½″ coal, 1″ inf coal, ½″ carb sh.
1″ coal, ¾″ fn sh, 1¼″ inf coal, 2″ coal
½″ carb sh, 8½″ coal
390′7¾″ 2¼″ fn sh.
4½″ inf coal
4¾″ coal
½″ br sh, ½″ coal, ¾″ l gy sh → slts
5″ coal, ½″ l gy sh.
1′7½″ coal with two ¼″ sh. bands
1″ carb sh, ½″ l gy sh, 2¼″ coal
1½″ l gy sh, 1″ coal, 1½″ fn sh.
394′11½″ 7″ coal with ½″ l gy sh at 5¾″
1¾″ l gy sh
l gy slts

N.S.232

Analysis	Recovery per cent		Section Sampled
A% 40·2			
S.G. 1·689			
Wash at S.G. 1·8*	100		658/61
Discard % 35·6			
A% of floats 21·4			
A% 56·0			
S.G. 1·891			
	92·65		659/61
	A% 83·1		Excl.
	S.G. 2·527		
A% 42·9			
S.G. 1·674			
Wash at S.G. 1·8*	82·93		660/61
Discard % 38·5			
A% of floats 26·7			

267′5¼″ l gy sh
1″ bluey, ¾″ d gy sh, 1½″ inf coal
5″ coal
2½″ bluey
6¾″ l gy sh.
1″ coal, ½″ d gy sh, 2″ coal
2½″ inf coal, ¾″ carb sh, ¾″ gy sh.
2″ coal, ¾″ carb sh, 3¾″ inf coal
¼″ carb sh, ½″ l gy slts.
6¾″ carb sh with two ½″ fn sh bands
1¼″ coal, ½″ carb sh, ¾″ l gy sh
2½″ bluey
5¾″ carb sh, 2½″ v inf coal
3″ fn sh
10¼″ inf coal
2½″ fn sh, 1¼″ carb sh
273′8½″ 1½″ l gy sh, ¼″ carb sh, ¾″ fn sh.
2½″ carb sh, ¾″ coal, ¾″ carb sh
2¾″ coal with ¼″ bands fn sh.
1½″ bluey, 1¾″ inf coal, 4″ coal
½″ gy sh
8¼″ coal with iron carb nodule 3″
½″ gy sh, 1¼″ carb sh, 2″ fn sh.
½″ carb sh, 2″ coal, ¾″ carb sh, ½″ coal
½″ l gy sh, 3½″ coal, ½″ l gy sh, 1″ coal
2″ carb sh, 1″ coal, 1¼″ fn sh, ½″ carb sh.
277′4″ 6½″ coal
3½″ fn sh, 1¾″ inf coal with iron carb
½″ carb sh, 1¾″ fn sh, 1½″ coal
¾″ carb sh, ¾″ inf coal, ½″ l fn slts
1″ inf coal, ½″ carb sh, 1¼″ inf coal
2″ fn sh, 4″ carb sh, ½″ gy sh, ¾″ coal
½″ carb sh, 3½″ coal, ½″ gy sh, 1″ coal
¾″ gy sh, ¼″ carb sh, 2½″ coal
¾″ carb sh, ¾″ inf coal, ½″ carb sh.
1½″ fn sh, ¾″ coal, 1¼″ carb sh, 1″ bluey
2½″ coal, 2″ carb sh, 1″ fn sh
281′7″ 2″ carb sh, 2″ inf coal, ½″ gy sh, ½″ fn sh, ¾″ carb sh, 2¼″ inf coal
3″ coal
3″ fn sh, 1¾″ bluey
1½″ coal, ¾″ inf coal, 1¼″ carb sh.
½″ gy sh, ¼″ carb sh, ½″ coal, ½″ carb sh
¾″ fn sh, ½″ carb sh.
6¼″ coal
½″ carb sh, 1″ d gy sh, 2½″ carb sh.
285′0″ 4½″ coal
1¼″ carb sh.
gy sh

N.S.233

Analysis	Recovery per cent		Section Sampled
A% 38·0			
S.G. 1·634			
Wash at S.G. 1·8*	87·50		664/61
Discard % 38·3			
A% of floats 23·1			
	A% 83·1		Excl.
	S.G. 2·440		
A% 56·3			
S.G. 1·876			
	96·58		666/61
A% 44·4			
S.G. 1·702			
Wash at S.G. 1·8*	100		667/61
Discard % 39·6			
A% of floats 26·3			

175′5½″ (gy sh)
2¼″ d gy sh, 1¼″ carb sh, 1″ coal
1″ gy sh, ¾″ bluey, 3″ coal
1¾″ carb sh
9¾″ l fn sh
1¾″ carb sh, 1¾″ coal
1¼″ carb sh, ½″ gy sh, 3″ coal
3¾″ carb sh
2¼″ fn slts, 3½″ carb sh
1¾″ inf coal, 3″ carb sh.
2½″ bluey, ¾″ gy sh.
2″ carb sh, 1″ inf coal, ½″ carb sh.
¼″ coal, 1¼″ fn sh, 2¼″ carb sh.
2½″ inf coal, 2½″ fn sh
3¼″ carb sh, ¾″ inf coal, ½″ coal
1¾″ bluey, 3″ carb sh.
1¼″ l gy sh, 1½″ carb sh, 3¼″ l gy sh
182′0½″ 3½″ carb sh
1¾″ coal with ¼″ fn sh, ½″ l fn sh.
1″ carb sh, 3½″ coal, ¾″ gy sh.
7¼″ coal
½″ carb sh, ¼″ fn sh, ¾″ coal, 2⅞″ fn sh
8″ coal
½″ l fn sh, ¾″ carb sh, 2¼″ l fn sh
4¼″ coal
185′8½″ 2½″ carb sh, 1¼″ coal, 1¼″ l fn sh.
2″ carb sh, 2¼″ l fn sh, ½″ carb sh
1¼″ coal, ¼″ carb sh, ¾″ fn sh
2¼″ inf coal, ¾″ carb sh, ¾″ coal, ¾″ gy sh, ¼″ carb sh, 1″ inf coal, 2¾″ carb sh.
1″ fn sh, 4″ carb sh.
3½″ bluey, 1″ coal
1¼″ fn sh, 3″ coal, 1″ inf coal, ½″ coal
1½″ gy sh, 3½″ carb sh
189′4¼″ 1″ coal, 1¼″ carb sh.
2¼″ fn sh, 1¾″ carb sh
2½″ coal, 3″ carb sh.
½″ coal, 1″ inf coal, ¾″ carb sh, ½″ coal
3″ fn sh, ½″ carb sh, 2″ coal
2½″ carb sh, ½″ coal, 1″ carb sh, 1″ coal
¼″ d gy sh, 2″ carb sh, 2¼″ inf coal
4¼″ coal
1″ inf coal, ¾″ carb sh, 3½″ coal
¾″ carb sh, 1″ d gy sh, 1″ bluey, 1¼″ carb sh, 1″ d gy sh, 1″ carb sh, ¼″ inf coal
193′5″ 8″ coal
d gy sh

N.S.234

Analysis	Recovery per cent		Section Sampled
A% 38·9			
S.G. 1·658			
Wash at S.G. 1·8*	92·83		896/61
Discard % 28·4			
A% of floats 23·7			
	A% 85·0		Excl.
	S.G. 2·505		
A% 50·1			
S.G. 1·811			
	97·41		898/61
A% 42·1			
S.G. 1·670			
Wash at S.G. 1·8*	98·65		899/61
Discard % 34·9			
A% of floats 27·1			
	A% 82·1		Excl.
	S.G. 2·486		
	A% 77·4		Excl.
	S.G. 2·280		

d gy sh
2″ gy slts.
2½″ coal
5½″ bluey
1″ gy sh.
9¾″ l fn sh.
1¼″ carb sh, 1¼″ fn sh
3½″ carb sh → bluey
1⅛″ coal, ¾″ carb sh, 1½″ br sh, ½″ carb sh, ½″ bluey, ½″ carb sh, ½″ br sh, ¾″ coal
3″ carb sh, ½″ inf coal, 3″ fn sh, ½″ bluey
2½″ carb sh, ¾″ fn sh, ¼″ carb sh, 1″ inf coal, ¼″ fn sh, ¾″ br sh, 2¼″ carb sh
2″ coal, ¾″ bluey, ½″ carb sh, ½″ inf coal
1¼″ carb sh, ¾″ coal, 1½″ d gy sh, ¾″ inf coal, 1″ carb sh, ½″ d gy sh, ½″ carb sh, ½″ coal, ½″ inf coal, 2½″ gy → fn sh, 1″ coal
½″ carb sh, 1½″ inf coal, ½″ coal, ¾″ carb sh, 5¼″ bluey, 3″ gy sh.
204′3½″ ⅝″ inf coal, ¾″ carb sh, 3½″ d gy sh.
211′2¾″ 1¾″ carb sh, ¼″ gy slts, ¾″ coal, ¼″ fn sh
2¼″ bluey, 4¼″ coal
½″ gy sh, ¼″ fn sh.
8¼″ coal with ¼″ fn sh.
½″ gy sh, ¼″ coal, 3″ l fn sh, ¾″ coal
½″ l fn sh, 1½″ coal, ¾″ fn sh.
4¾″ coal, ½″ fn sh.
¾″ inf coal, ¾″ fn sh, 1″ coal, 1¼″ l fn sh.
10″ coal
215′0″ 1¾″ fn sh, 1¾″ bluey, 1¼″ coal
¼″ carb sh, ¾″ br sh, 1¼″ carb sh, 1″ inf coal, 3½″ carb sh, ½″ coal, 1¾″ carb sh
¾″ l gy sh, ¾″ carb sh, ¼″ fn sh, ¼″ coal
216′7¼″ ½″ bluey, ¼″ br sh, 1¼″ inf coal, ¾″ gy sh, 1½″ carb sh, 7″ coal
1″ l gy sh
5″ coal, 1″ gy slts.
1½″ coal, ½″ gy sh, 3½″ coal
1″ carb sh, 1″ d gy sh, ½″ carb sh, 1¼″ coal with ¼″ fn sh, ¼″ gy sh, ¼″ coal, ½″ d gy sh.
1″ carb sh, 4¼″ coal with ¼″ sh.
3″ fn sh, ½″ carb sh.
5″ coal, ¾″ gy sh
2½″ coal, ¾″ gy sh.
10″ coal
¾″ d gy sh, 2″ coal
2½″ d gy sh, 2″ inf coal
222′9″ 10¼″ coal w. three ¼″ sh. bands
1⅛″ gy sh.
gy. slts

* for washability see Table I

MOGGILL MINE AREA–DETAILED SEAM SECTIONS

RIVERSIDE No.3 SEAM

N.S.235

Analysis	Recovery per cent	Section Sampled
A% 37·3		
S.G. 1·646	A% 83·0	Excl.
Wash at S.G. 1·8*	S.G. 2·466	
Discard % 20·9	100	904/61
A% of floats 23·6		
A% 59·3		
S.G. 1·961	100	906/61
A% 41·0		
S.G. 1·695	98·65	907/61
Wash at S.G. 1·8*		
Discard 36·3	A% 83·1	Excl.
A% of floats 24·2	S.G. 2·509	

292'4¼" gy.sh
2" coal, some inf.
3½" d.gy.slts ½" gy.sh.
2" coal 1" carb.sh. 2½" coal
1¼" bluey 1¼" d.gy.sh 1¼" inf.coal ½" carb.sh ¼" d.gy.sh. 2" inf.coal 1½" f.sh. 1½" inf coal
3¾" bluey
1¼" carb.sh 1¼" inf.coal ½" carb.sh
2" gy.sh ¼" carb.sh 1¼" inf.coal
½" f.sh. 4" bluey
1" coal 4½" bluey
½" coal 4" f.sh.
1¼" inf.coal 1¾" gy.sh.
297'½" 2¼" carb.sh. 1¼" inf.coal
1" coal 1½" carb.sh. 2¼" coal
½" d.gy.sh. 6¾" coal
¾" gy.sh. ¼" coal
2¾" f.sh with ¼" carb.sh. 1½" coal
1" carb.sh. ½" f.sh. 6" coal
½" gy.sh ½" carb.sh. ½" gy.sh ¾" coal
1½" f.slts. 1" boulder 3¼" coal
½" boulder ¾" coal 1½" bluey
300'8¾" 2¾" coal 3¾" bluey
2" f.sh. 1½" bluey
2¼" f.sh. 2" inf.coal
1" f.sh. 2¾" bluey ½" carb.sh.
½" d.gy.sh. 1½" carb.sh. ¾" inf.coal
302'4¼" ¼" f.sh. ½" carb.sh. 2¾" bluey 1¼" f.sh ½" inf.coal ¼" d.gy.sh 1¾" bluey
5" coal ¼" d.gy.sh 1" inf.coal
5½" coal
½" carb.sh. 1¼" f.sh 1½" inf.coal
1¼" carb.sh 1½" coal 1½" bluey ¾" d.gy.sh ¼" coal 1¼" gy.sh 1" carb.sh. ¾" coal
½" f.sh. 2" coal ½" f.sh 1" carb.sh.
1¾" inf.coal 1" carb.sh 1" coal ½" d.gy.sh.
1¾" coal 2½" gy.sh. ¾" carb.sh.
1¼" bluey 6¾" coal
¾" gy.sh. 1¼" coal 1¼" ironstone
¾" coal 3" inf.coal ½" carb.sh
½" l.gy.sh. 1¼" inf.coal ¾" coal ¼" d.gy.sh 2¾" carb.sh ¾" gy.sh. 1" carb.sh.
9¾" coal
308'6" ½" carb.sh 1" d.gy.sh ½" coal 1½" gy.sh.
309'0" 2½" carb.sh with iron carb.nods.
d.gy.sh

N.S.237

Analysis	Recovery per cent	Section Sampled
A% 37·2		
S.G. 1·611		
Wash at S.G. 1·8*	91·67	913/61
Discard % 29·5		
A% of floats 24·9		
A% 84·7		Excl.
S.G. 2·515		
A% 79·1		Excl.
S.G. 2·504		
A% 56·3		
S.G. 1·910	97·56	916/61
A% 41·1		
S.G. 1·667		
Wash at S.G. 1·8*	94·51	917/61
Discard 33·6		
A% of floats 28·8		

447'3" gy.sh
2" inf.coal 1¾" f.sh.
2½" carb.sh. ¼" gy.sh.
2" coal ¼" gy.sh. ½" inf.coal
1¾" carb.sh. ¼" coal
2" l.f.slts. 5" carb.sh
1" coal 1" carb.sh. 1" coal
1¾" bluey 1" coal ½" f.sh. 1½" inf.coal
½" coal 1¼" carb.sh 1½" f.sh 1¼" slts.
¾" carb.sh 1½" inf.coal ¾" l gy.sh.
2½" bluey ¾" carb.sh. ¾" bluey ¾" coal
7" bluey
1" coal 2" f.sh
½" bluey 1¾" coal 2" f.sh
452'4" 1¾" carb.sh ¼" d.gy.sh 1¼" coal
½" carb.sh. 2¾" coal 1¼" gy.sh.
2¾" coal with ¼" sh & ¾" bluey
1¾" bluey 1½" coal ¼" carb.sh. ½" d.gy.sh
11¾" coal with two ¼" gy.sh. bands
½" gy.sh. ½" coal 2¾" f.sh. ¼" carb.sh.
2¼" coal with ¼" f.sh. 1¼" inf.coal
¾" l.f.slts. 6½" coal
½" f.sh. ½" coal 2¼" f.n & gy.sh.
½" coal ½" bluey 1½" coal
1" carb.sh. ¾" coal 1½" carb.sh 1½" coal
457'4" 4½" bluey 1" coal
1¼" f.n.sh. 2" bluey 3" f.n.sh.
½" inf.coal ½" carb.sh. ¾" inf.coal ¼" f.n.sh. ¾" carb.sh. ½" f.n.sh. 4" bluey
¾" f.n.sh. 1½" coal 1½" carb.sh
2" coal ½" carb.sh. 1¼" bluey 1½" f.n.slts.
3½" coal. 1½" inf.coal
1" coal ¾" f.n.sh. 2½" coal
1" inf.coal 3½" l f.n.slts.
5½" coal
½" gy.sh. ¾" carb.sh. 3" carb.sh.
¼" f.n.slts. 3¼" inf.coal 1" carb.sh.
2½" coal 2¾" carb.sh.
462'5¼" 1¼" inf.coal 2¼" f.n.sh.
2½" bluey
6½" coal with ¼" f.n.sh. & ¼" g.sh
1½" f.wn.sh.
2¾" bluey 2" inf.coal
4¾" coal ¾" gy.slts.
4" bluey
7½" coal
4½" inf.coal
465'10¼" 1¼" coal 1" carb.sh.
l gy.slts.

N.S.240

Analysis	Recovery per cent	Section Sampled
A% 37·1		
S.G. 1·605	A% 84·8	Excl.
Wash at S.G. 1·8*	S.G. 2·519	
Discard % 23·3	97·45	922/61
A% of floats 18·4		
	A% 66·7	Excl.
	S.G. 2·334	

402'11" l gy.slts.
9½" carb.sh.
1¼" gy.sh. 3" gy.slts.
1¾" l.gy.f.ss. 3" d.gy.sh.
2" inf.coal ¼" d.gy.sh. 2" f.n.sh.
2½" carb.sh. 1" gy.sh.
6" carb.sh.
½" inf.coal 3¾" carb.sh.
1" coal 3¾" carb.sh.
2¼" gy.sh. 2¼" bluey ¾" coal
2½" inf.coal → coal
5" bluey
2¼" gy.sh. 1¾" inf.coal
408'2" 1¾" f.n.sh., 2½" carb.sh. ¼" coal
4½" carb.sh & coal ½" f.n.slts.
4" coal 1" carb.sh.
3½" coal ½" gy.sh.
9¾" coal with ¾" inf.coal at 2"
¾" gy.sh. ½" coal ¾" gy.sh. 2" f.n.sh.
2½" coal 1¼" carb.sh. ½" inf.coal
1" f.n.sh. 5¾" coal
½" f.n.sh. 1¼" inf.coal
2½" l. f.n.sh. 1¼" inf.coal 1½" f.n. slts.
¼" carb.sh.
412'11¼" 10¼" coal → inf.coal
½" d.gy.sh. ¼" carb.sh. 2¼" f.n.sh
1¾" inf.coal 2¾" f.n.slts.
3¾" carb.sh. with ¼" f.n.sh. ½" gy.sh.
3½" carb.sh. ½" f.n.sh. 1½" carb.sh.
¾" b.n.sh. 1½" carb.sh. 1" bluey 1¼" carb.sh 1½" bluey ½" carb.sh. 1¼" f.n.sh. ½" carb.sh. 1" coal 4" bluey
2½" coal with ½" gy.sh
¾" l gy.sh. 3¾" inf.coal
3" l f.n.sh.
1¼" coal ¼" f.n.sh. 1¾" carb.sh. ¾" coal
½" inf.coal ½" f.n.sh. 2½" carb.sh.
1¾" f.n.sh. ¾" inf.coal ¾" f.n.sh.
1½" carb.sh. 2½" coal
4½" carb.sh.
5½" f.n.sh.
1¼" carb.sh. 3¼" inf.coal ¼" gy.sh.
¾" coal 1½" bluey 3½" coal
2¼" inf.coal 1" f.n.sh.
3½" bluey
2¾" carb.sh. 1" coal 1¼" boulder
¼" coal 2" carb.sh. 2¾" bluey
1½" coal 1" carb.sh. ¼" gy.sh. ½" coal
¾" carb.sh. 1" inf.coal ½" f.n.sh.
422'1" 1¼" coal 1" gy.sh. 1" bluey 3¼" carb.sh gy.sh.

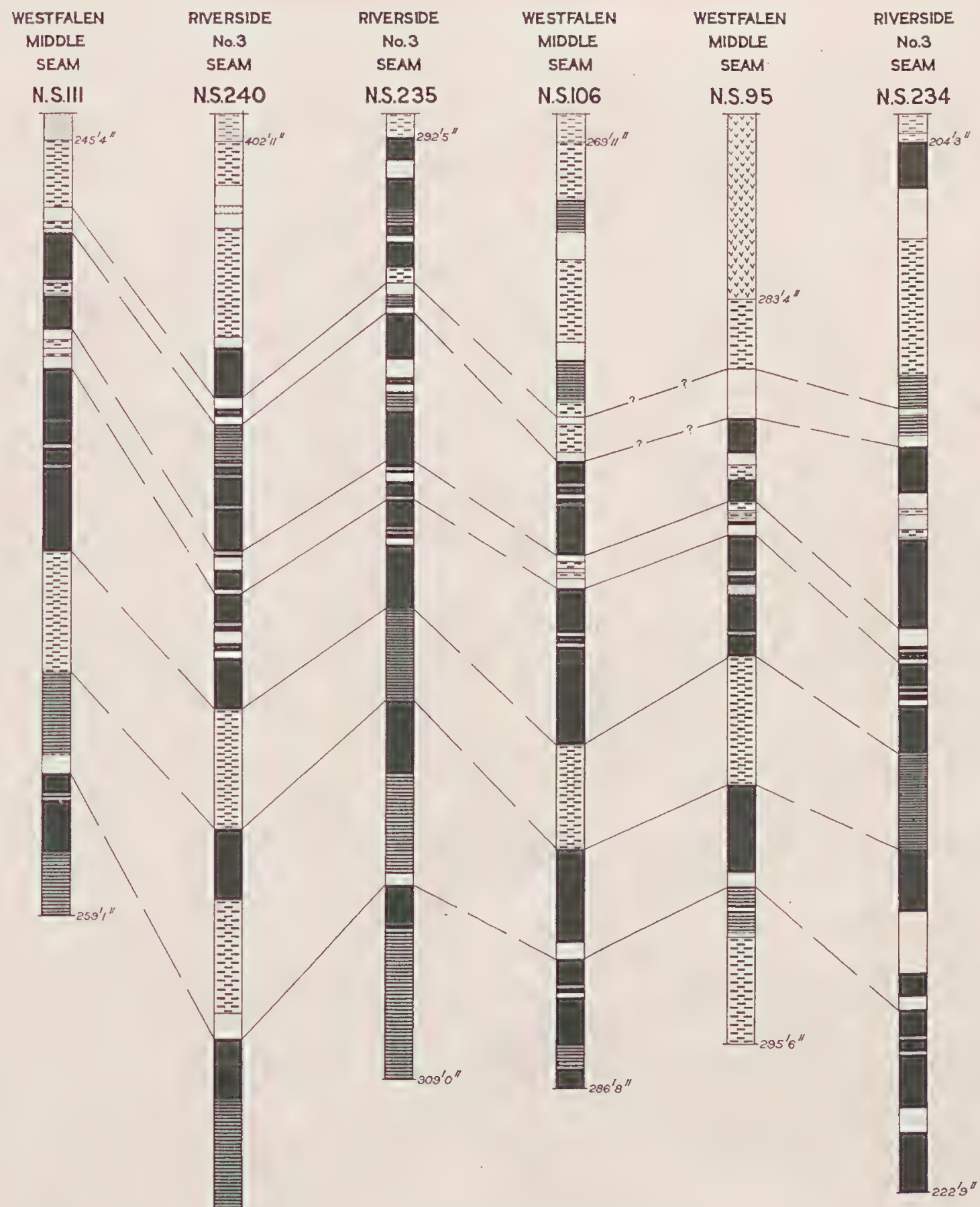
M/R3/1

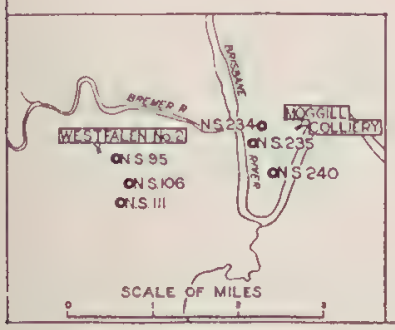
(Sampling & description by Queensland Coal Board)

	A% 38·2	7½" coal
		3" stone
		3" carb.sh.
	A% 48·0	8" inf.coal
		1½" stone
Two coal bands		4" coal
	A% 37·4	2½" stone
		7½" coal
		4" stone
Eight stone bands		5" banded bluey & stone
A% 71·3	A% 40·3	1'8" banded coal
	A% 34·5	2¼" stone
		11" coal
		4½" stone
	A% 27·2	8" coal
Four inf.coal bands		2½" inf.coal ¼" stone
	A% 42·9	7½" inf.coal
		1" stone 2½" inf.coal
		1" stone 4" inf.coal
Two coal bands		1" stone
	A% 31·5	8" coal
		½" stone 4½" coal
Twelve stone bands		1½" stone 1" coal ½" stone
A% 76·1		4" coal
Three coal bands		1½" stone 2½" coal 1" stone
	A% 40·8	5" inf.coal
	A% 47·6	½" stone 5½" coal
	A% 40·2	3" stone
	A% 34·8	10" coal
		1" stone
	A% 35·1	1'11½" coal

* for washability see Table I

CORRELATION DIAGRAM
RIVERSIDE No.3 SEAM & WESTFALEN MIDDLE SEAM





SCALE OF FEET

3 0 3 6

LEGEND

Sandstone		Coaly shale	
Siltstone		Coal & shale	
Shale		Coal with sh. bands	
Basalt	V V V		

ERRATA

p. 21 column 2 line 21, for "over" read "ever"

p. 29 column 1 second last line, for "Brisbie" read "Bribie"

Plate 1 line 2 of inscription, for "overriden" read "overridden"

Fig. 1 and Inset. Numbers on scales should be halved; i.e. scales shown are half correct scale

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 307

TRIASSIC SPORES AND POLLEN GRAINS FROM THE IPSWICH COALFIELD

By N. J. de JERSEY, Ph.D., M.Sc., Supervising Geologist

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ABSTRACT

Thirty-three species of spores and pollen grains from the seams of the Ipswich Coal Measures have been described and illustrated by photographs. Of these, sixteen are proposed as new species, the remainder being either identified with species previously described from Australia and Europe, or described and illustrated, where insufficient evidence exists for use of a specific name. Two new genera—Circulisporites *and* Tenuisaccites—*have been proposed, the former for small circular alete spores with an ornament of concentric striations, and the latter for monosaccate pollen grains with a thin, fragile saccus and a relatively thicker, alete, oval corpus. The investigation has provided a basis for a detailed account of species distribution through the stratigraphic sequence of the Ipswich Coal Measures. The description of a microflora of well-established Triassic age will also find application in the study of other Triassic microfloras of Queensland, particularly in the sediments of the Artesian Basin.*

1. INTRODUCTION

The investigation recorded here has been based on an examination of fifty coal samples from the major seams of the Ipswich coalfield. These seams are all from formations within the Ipswich Coal Measures, regarded as Middle to Upper Triassic in age. A few thin coal seams, one of which has been worked to a limited extent, are also known in the lower part of the Bundamba Group, which disconformably overlies the Ipswich Coal Measures. The present account is restricted to the microflora of the Ipswich Coal Measures, leaving that of the Bundamba Group to be described in a later, separate, paper.

Spores and pollen grains have been found in all the samples examined, good yields being obtained in most cases. As very little has previously been published on the Triassic microfloras of Australia, the purpose of the present investigation has been to describe the principal species present, leaving their distribution in the coal seams to be recorded in detail in a later publication. The only previous work published on Triassic microfloras of Queensland is a preliminary paper by the writer (de Jersey 1949) on spores and pollens from the Ipswich coals. In this paper a numerical system of classification was used; it may be regarded as being superseded by the present work, in which the spores and pollens are described and named as genera and species on a binomial basis.

2. EXPERIMENTAL METHOD

The coal samples studied were derived from two sources—channel samples collected in colliery workings and cores obtained in the course of the diamond drilling programme of the Queensland Department of Mines in the Ipswich Coalfield. Each sample was first crushed down to approximately quarter-inch screen size and sampled by conventional quartering methods; the coal was then further crushed down to minus 16 mesh (B.S.S.) size and again sampled, dust and finely divided coal being removed by screening through a 36-mesh (B.S.S.) sieve. Shale and shaly coal were then removed as the sinks in carbon tetrachloride (specific gravity 1·58); the float fraction thus consisted of relatively clean coal and the proportion of inorganic material in the final maceration residue was accordingly reduced. After air-drying, portion of this final sample was subjected to maceration with Schulz solution. This was effected by mixing 4 grams with 6 grams of potassium chlorate, adding 50 ml. concentrated nitric acid, and allowing the mixture to stand overnight (16–17 hours) at room temperature. The oxidised coal was then washed to neutrality, and treated with 100 ml. 10 per cent. NaOH solution, then again washed to neutrality by decantation, allowing several hours for settlement between each wash. The final maceration residue was mounted on micro-slides, using a Canada balsam-xylol solution as the mounting medium. Six micro-slides were prepared, on the average, for each sample.

The micro-slides were traversed systematically with the aid of a mechanical stage, 500 specimens being examined for most samples, the exceptions being in the case of a few seams near the base of the sequence, which gave a relatively low yield of spores and pollens. Specimens selected for photographing were located by means of their stage coordinates expressed to the nearest 0·1 mm. As mechanical stages are subject to considerable variation in different microscopes, the coordinates of an additional, easily located, reference point, selected as the lower right-hand corner of the cover glass of each slide, have been determined in each case. This reference point is quoted in the text, along with the coordinates of each holotype or figured specimen, so that with this information the specimens can be readily located by means of any microscope equipped with a mechanical stage.

3. CLASSIFICATION OF SPORES AND POLLEN GRAINS

The spores and pollen grains have been described as genera and species on the basis of accepted taxonomic procedure. The order of arrangement of the genera has been to indicate, as far as possible, affinities with natural groups, rather than according to the artificial scheme of supra-generic groups described by Potonié (1956, 1958, 1960). Although Potonié's system has considerable merit and utility, clearly evident in grouping genera of unknown affinity, it is considered that sufficient evidence has accumulated, and is accumulating, for Mesozoic spores and pollens, such as those recorded here, to be grouped on the basis of natural affinities. Accordingly, the first tentative step in that direction, as far as this Triassic microflora is concerned, has been taken in the present investigation. The headings, based on natural plant groups, under which the various specific descriptions are arranged, should thus be regarded as suggesting the probable affinities of those species, rather than as dogmatic assertions of definite relationship.

4. SYSTEMATIC DESCRIPTIONS

? Fungal Spores

Genus INAPERTISPORITES van der Hammen ex Rouse

Remarks.—The generic name *Inapertisporites* has recently been validated by Rouse (1959, p. 312) to provide an appropriate designation for fossil spores "which appear to be fungal, algal or possibly bryophytic in affiliation". As Rouse points out "The scope of this genus would appear to overlap with *Inaperturopollenites* Thomson and Pflug (1953). However the generic and specific descriptions of the latter genus point specifically to certain groups of pollen, particularly those of the Taxodiaceae, *Larix* and *Populus*, and no provision is made to provide adequate reference for spores of probable fungal, algal or bryophytic relationship."

The validation of this generic name by Rouse is welcomed, as it provides a useful designation for the small alete spores, of probable fungal affinity, which are widely distributed in Queensland Triassic and Jurassic coals. The writer has previously recorded two species of spores of this type from the Jurassic coals of the Walloon Coal Measures as *Pilasporites minutus* and *P. crassus* (de Jersey 1959, p. 359). The generic name *Pilasporites* Balme and Hennelly was used in this case to distinguish these spores from the larger inaperturate pollens, of probable coniferous affinity, recorded under the generic name *Inaperturopollenites*. *Pilasporites*, however, appears to be somewhat inappropriate as a designation for the Mesozoic spores as the two Permian species described are relatively thick walled and also show differential thickening of the exine. These features are less in evidence in the two Mesozoic species described by the writer and consequently these species are both now transferred to *Inapertisporites* van der Hammen (1955) ex Rouse.

Inapertisporites minutus (de Jersey), new combination

Plate1, Figures 1 and 2.

Pilasporites minutus de Jersey, 1959, Qld. Govt. Min. J. **60,** 359, pl. 2, fig. 11.

Emended diagnosis.—Outline circular or subcircular. No germinal mechanism visible. Diameter (based on 131 measured specimens) 7 to 20 microns. Exine smooth, one micron or less in thickness.

Remarks.—The specimens recorded here are closely similar to those previously recorded under this specific name from the Walloon Coal Measures, the only difference being that they have a slightly larger size range (7 to 20 microns) as against 7 to 17 microns for the Walloon specimens. The species has a general similarity to *I. laevigatus* Rouse, but the latter species exhibits a small incurved region of the wall probably acting as a germinal aperture which has not been observed in the Ipswich or Walloon specimens.

Figured specimen (Plate 1, Figure 1).—Slide No. 229, Stage coordinates 15·0, 110·1; diameter 14 microns. Coordinates of lower right hand corner of cover glass 3·2, 119·9.

Figured specimen (Plate 1, Figure 2).—Slide No. 257, Stage coordinates 9·0, 106·4; dimensions 18 x 14 microns. Coordinates of lower right-hand corner of cover glass 3·5, 121·6.

Inapertisporites crassus (de Jersey), new combination

Plate 1, Figures 3, 4 and 5.

Pilasporites crassus de Jersey, 1959, Qld. Govt. Min. J. **60,** 359, pl. 2, fig. 12.

Emended diagnosis.—Outline circular or subcircular. No germinal mechanism normally visible; a few specimens exhibit thinner regions of the spore wall suggestive of germinal apertures. Diameter (based on 30 measured specimens) 7 to 22 microns. Exine smooth, thick walled or deeply pigmented, appearing dark brown in transmitted light.

Remarks.—The specimens recorded here are specifically indistinguishable from those previously recorded as *Pilasporites crassus* from the Walloon Coal Measures in the Rosewood coalfield (de Jersey 1959, p. 359). Further study of the species suggests that the dark colour in transmitted light may equally as well be a result of deep pigmentation as of a thick exine. Consequently the specific diagnosis has been emended to indicate this possibility and also to record the slightly greater size range of the Ipswich specimens. Among the latter several have been observed with thinner portions of the spore wall suggestive of germinal apertures. Two such specimens are figured (Plate 1, figs. 4 and 5) and this characteristic has also been recorded in the emended diagnosis.

Figured specimen (Plate 1, Figure 3).—Slide No. 112, Stage coordinates 6·0, 118·3; diameter 15 microns. Coordinates of lower right-hand corner of cover glass 2·5, 121·8.

Figured specimen (Plate 1, Figure 4).—Slide No. 113, Stage coordinates 10·4, 111·3; dimensions 22 x 17 microns. Coordinates of lower right-hand corner of cover glass 2·8, 120·0.

Figured specimen (Plate 1, Figure 5).—Slide No. 20, Stage coordinates 17·0, 108·55; dimensions 17 x 15 microns. Coordinates of lower right-hand corner of cover glass 2·8, 123·3.

Division BRYOPHYTA
Class MUSCI
Family SPHAGNACEAE
Genus SPHAGNUMSPORITES Raatz

Sphagnumsporites adnatus de Jersey

Plate 1, Figure 6.

Emended diagnosis.—Amb rounded triangular to sub-circular. Trilete, laesurae extending about two-thirds the distance to the periphery. Diameter (based on 68 measured specimens) 21 to 42 microns. Contact area marked by a proximal sub-triangular to circular thickening of the exine, normally extending to ends of laesurae. Diameter of contact area 13 to 26 microns. Exine smooth, thickness 1 to 3 microns.

Remarks.—The Ipswich specimens are specifically indistinguishable from *S. adnatus,* previously described by the writer from the Rosewood coals (de Jersey 1959, p. 348). The diagnosis has been emended to record the slightly greater range in diameter and thickness of exine observed in the present material.

Figured specimen (Plate 1, Figure 6).—Slide No. 205, stage coordinates 8·15, 113·8; diameter 28 microns. Coordinates of lower right-hand corner of cover glass 3·0, 118·2.

Sphagnumsporites tenuis de Jersey

Plate 1, Figures 7 and 8.

Diagnosis (de Jersey 1959, p. 348).—Amb rounded triangular to sub-circular. Trilete, laesurae extending to, or almost to, the periphery. Diameter (based on 33 measured specimens) 20 to 40 microns. Exine smooth, about 1 micron in thickness.

Remarks.—The spores recorded here are closely similar to the Rosewood specimens for which the species was proposed. The specimens figured (Plate 1, Figures 7 and 8) are close to the lower and upper limits of the size range respectively. Spores of this simple, generalised type may be derived from several natural species, and while they have been included here in *Sphagnumsporites,* and tentatively regarded as having affinity with the Sphagnaceae, they could quite possibly have affinity with the Osmundaceae, and thus be referable to Couper's genus *Todisporites* (Couper 1958, p. 134).

Figured specimen (Plate 1, Figure 7).—Slide No. 205, Stage coordinates 18·5, 110·4; diameter 21 microns. Coordinates of lower right-hand corner of cover glass 3·0, 118·2.

Figured specimen (Plate 1, Figure 8).—Slide No. 20, Stage coordinates 16·5, 108·5; diameter 36 microns. Coordinates of lower right-hand corner of cover glass 2·8, 123·3

Division CALAMOPHYTA
Class EQUISETINAE
Order EQUISETALES
Genus CALAMOSPORA Schopf

Calamospora tener (Leschik), new combination
Plate 1, Figures 9 and 10.

Laevigatisporites tener Leschik, 1955, Schweiz. Paläont. Abh. **72,** 13, pl. 1, fig. 20.

Punctatasporites flavus Leschik, 1955, Schweiz. Paläont. Abh. **72,** 31, pl. 4, fig. 2.

Calamospora mesozoica Couper 1958, Palaeontographica **103B,** 132, pl. 15, figs. 3, 4.

Calamospora nathorstii (Halle) Klaus 1960, Jahrb. Geol. B.A., Sonderb. 5, 116, pl. 28, fig. 1.

Emended diagnosis.—Amb originally circular, normally distorted by folding. Trilete, laesurae short, inconspicuous, about half radius of spore. Diameter 25 to 55 microns. Exine smooth, colourless to pale yellow, very thin (less than 1 micron).

Remarks.—The Ipswich specimens referred to this species have a continuous size range from 36 to 55 microns (based on 37 measured specimens). The size range quoted by Couper (1958, p. 132) describing similar spores from the Lower and Middle Jurassic of Great Britain was from 25 to 48 microns. As the Ipswich and British spores are similar in all other respects, Couper's size range has been extended in the above emended diagnosis to include spores from both areas.

A discussion of the synonymy of the species by Klaus (1960, pp. 116-118) makes it clear that dispersed spores of this type were first described by Leschik under the name *Laevigatisporites tener.* Klaus also shows that *Calamospora* is a more appropriate generic name than *Laevigatisporites.* The writer cannot follow Klaus, however, in attributing the species, at least as far as the Ipswich specimens are concerned, to the new combination *Calamospora nathorstii* (Halle) Klaus. The species *Equisetites nathorstii* was proposed by Halle (1908, p. 28) for Equisetalean macrofossils, from which spores were extracted by maceration. The size range given by Halle for these spores is from 35 to 40 microns, which is much more restricted than that of the Ipswich specimens (36 to 55 microns). Furthermore the species *Equisetites suecicus* (Nathorst) Halle has spores, otherwise similar, but with a size range from 40 to 50 microns. Consequently the Ipswich spores, which show a continuous size gradation, cover the size ranges of at least two species of *Equisetites.* The writer

has thus followed the course of interpreting the dispersed species broadly, so as to include the whole of the size range for both the European and Australian specimens, and it is considered preferable, at least for the Ipswich material, to keep the terminology for dispersed spores distinct from that for spores derived from macrofossils.

Figured specimen (Plate 1, Figure 9).—Slide No. 231, Stage coordinates 4·85, 112·1; dimensions 53 x 45 microns. Coordinates of lower right-hand corner of cover glass 3·2, 115·5.

Figured specimen (Plate 1, Figure 10).—Slide No. 229, Stage coordinates 9·9, 118·2; dimensions 50 x 45 mircons. Coordinates of lower right-hand corner of cover glass 3·1, 119·9.

Division PTEROPHYTA
Class FILICOPSIDA
Order FILICALES
Family OSMUNDACEAE
Genus OSMUNDACIDITES Couper

Osmundacidites parvus, new species
Plate 1, Figures 11 and 12.

Diagnosis.—Amb circular or sub-circular. Trilete, well defined laesurae, extending to, or almost to, the periphery. Diameter (based on 20 measured specimens) 28 to 39 microns. Exine about 1 micron thick, pale yellow or light yellow, frequently folded, with folds of an arcuate nature. Ornamentation granular-papillate, with projections 0·5 to 1 microns in diameter, set about 1 micron apart. No marked reduction of ornament in proximal region.

Remarks.—The species differs from *O. wellmanii* Couper, from the Jurassic and lower Cretaceous of New Zealand and Great Britain (Couper 1953, p. 20; 1958, p. 134) in being distinctly smaller (size range 28 to 39 microns) as against 40 to 63 microns for Couper's species. In addition the laesurae are somewhat more distinct in the Ipswich specimens. Another species, *O. alpinus,* has recently been described by Klaus (1960, p. 127) from the European Triassic. This species is somewhat smaller in average size (size range 25 to 33 microns) than the Ipswich spores and also has much weaker, relatively indistinct laesurae, as is evident from the figure of the holotype (Klaus 1960, pl. 31, fig. 26).

Holotype (Plate 1, Figure 11).—Slide No. 53, Stage coordinates 14·4, 123·1; diameter 29 microns. Coordinates of lower right-hand corner of cover glass 3·8, 124·8.

Figured specimen (Plate 1, Figure 12).—Slide No. 145, Stage coordinates 11·5, 113·6. Coordinates of lower right-hand corner of cover glass 2·3, 118·7 (three specimens of tetrad).

Locality of holotype.—Bore N.S. 183 (Ipswich Coalfield), 1,460 ft. 3 in. to 1,472 ft. 4¼ in. (Wright seam).

Spores—Incertae Sedis

Genus LEIOTRILETES (Naumova) Potonié and Kremp

Leiotriletes directus Balme and Hennelly
Plate 1, Figure 13.

Remarks.—The writer's previous remarks on Rosewood specimens referred to this species apply equally well to the Ipswich material. They are as follows (de Jersey 1959, p. 354):—"Under this species are recorded small, trilete, triangular forms indistinguishable from the Permian spores described by Balme and Hennelly (1956B, p. 244). As stated by those authors, *L. directus* is a very broad category embracing the spores of many plants. Thus an extended range, through several geological periods, is not unexpected for such a simple, generalised type of spore".

In the Ipswich specimens the diameter (based on 44 measured specimens) ranges from 18 to 38 microns; the exine is thin, smooth and frequently folded (see Plate 1, Figure 13).

Figured specimen (Plate 1, Figure 13).—Slide No. 118, Stage coordinates 16·0, 105·4; diameter 31 microns. Coordinates of lower right-hand corner of cover glass 2·5, 115·3.

Genus CONCAVISPORITES (Pflug) Delcourt and Sprumont

Concavisporites mortoni (de Jersey), new combination
Plate 1, Figures 14 and 15

Leiotriletes mortoni de Jersey 1959, Qld. Govt. Min. J. **60,** p. 354, pl. 1, fig. 15.

Emended diagnosis.—Amb triangular, apices rounded, sides straight, slightly concave or convex. Trilete, laesurae distinct, extending almost to the periphery, bordered by three ridges (tori), 2 to 5 microns in width, concave towards the equator, sometimes joining around the ends of the laesurae. Diameter (based on 57 measured specimens) 20 to 40 microns. Exine 1 to 1·5 microns thick, smooth, pale yellow to light brownish yellow.

Remarks.—This species was originally described by the writer from the Rosewood coals as *Leiotriletes mortoni* (de Jersey 1959, p. 354). Its occurrence in greater abundance in the Ipswich samples has enabled more detailed study of its morphology, and it has become clear that the thickenings on each proximal face are identical with the "tori" or "Kyrtomen" which are a characteristic feature of *Concavisporites* (Potonié 1956, p. 15). Consequently the species is now transferred to the latter genus. Delcourt and Sprumont (1955), in their re-definition of *Concavisporites,* regard the concavity of the sides, in polar view, as a generic character, in addition to the presence of tori. However, from a study of the Ipswich specimens it is clear that there is a continuous gradation from slightly concave to slightly convex sides. Accordingly, in view of such variation within the species, little importance has been attached to this latter character, and the presence of tori has been regarded as a more important

diagnostic feature in transferring the species to *Concavisporites*. The specimens illustrated in Plate 1, Figures 14 and 15, indicate the range of variation in outline (from slightly concave to convex sides).

C. mortoni is specifically distinguishable from the genotype, *C. rugulatus* Pflug by the absence of the subsidiary folds and undulating laesurae of the latter species; from *C. punctatus* Delcourt and Sprumont by its lack of ornamentation, and from *C. baldurnensis* Delcourt and Sprumont by the much greater size of the latter species.

Figured specimen (Plate 1, Figure 14).—Slide No. 7, Stage coordinates 13·2, 114·9; diameter 31 microns. Coordinates of lower right-hand corner of cover glass 4·5, 120·6.

Figured specimen (Plate 1, Figure 15).—Slide No. 60, Stage coordinates 10·1, 106·1; diameter 36 microns. Coordinates of lower right-hand corner of cover glass 3·8, 119·8.

Genus ANNULISPORA de Jersey

Remarks.—The genus *Annulispora* was proposed by the writer (de Jersey 1959, p. 358) for spores with a distinctive ring structure on the distal surface, from the Jurassic of Poland and Queensland. Since then another genus, *Distanulisporites,* has been proposed by Klaus (1960, p. 131) for spores with a distal ring structure from the Triassic of Austria. Although fairly close to *Annulispora,* it seems likely that *Distanulisporites* can be maintained as a distinct genus by reason of (1) its longer laesurae which may extend as far as the equator in contrast to those of *Annulispora* which normally do not so do, (2) the presence of thickenings at the ends of the laesurae which have not been observed in *Annulispora* and (3) the punctate ornamentation in contrast to the normally smooth character of *Annulispora.*

Annulispora folliculosa (Rogalska) de Jersey
Plate 1, Figure 18

Remarks.—The writer has described this species (de Jersey 1959, p. 358) from the Walloon Coal Measures in the Rosewood coalfield. The Ipswich specimens recorded here are closely similar to those from the Rosewood coals and are covered by the diagnosis previously published. The species is relatively rare in the Ipswich coals and most of the specimens came from the Blackstone Formation, the highest formation in the sequence.

Figured specimen (Plate 1, Figure 18).—Slide No. 18, Stage coordinates 12·45, 107·9; diameter 28 microns. Coordinates of lower right-hand corner of cover glass 4·4, 123·6.

Annulispora microannulata, new species
Plate 1, Figures 16, 17 and 19

Diagnosis.—Amb sub-circular. Trilete, laesurae distinct, extending about two-thirds of the spore radius. Diameter (based on 20 measured specimens) 25 to 45 microns. Exine smooth, 1·5 to 3 microns thick at equator. Distal portion of the spore wall with a sub-circular ring of thickened exine, average width 5 microns. Internal diameter of ring 2 to 4 microns, external diameter 8 to 17 microns.

Remarks.—*A. microannulata* is distinguished from *A. folliculosa* by the smaller size of its distal ring structure, particularly of the internal diameter of the ring which is markedly less (2 to 4 microns) than that of *A. folliculosa* (7 to 17 microns). It has not yet been observed in samples from sediments younger than the Ipswich Coal Measures.

Holotype (Plate 1, Figure 19).—Slide No. 20, Stage coordinates 11·95, 116·6; diameter 40 microns. Coordinates of lower right-hand corner of cover glass 2·8, 123·3.

Figured specimen (Plate 1, Figure 16).—Slide No. 71, Stage coordinates 9·5, 111·1; diameter 29 microns. Coordinates of lower right-hand corner of cover glass 2·1, 120·6.

Figured specimen (Plate 1, Figure 17).—Slide No. 20, Stage coordinates 17·0, 119·8; diameter 31 microns. Coordinates of lower right-hand corner of cover glass 2·8, 123·3.

Locality of holotype.—Bore N.S. 186 (Ipswich Coalfield), 1482 ft. 8¼ in. to 1486 ft. 2½ in. (Aberdare seam).

Genus GRANULATISPORITES (Ibrahim) Potonié and Kremp

Granulatisporites minor de Jersey
Plate 1, Figure 20; Plate 2, Figure 1

Emended diagnosis.—Amb triangular, sides straight or slightly convex in polar view. Trilete, laesurae indistinct, extending to the periphery. Diameter (based on 44 measured specimens) 17 to 45 microns. Exine about 1 micron thick, ornamented with small, closely packed granulations (diameter about 1 micron); ornamentation becoming slightly papillate at the periphery.

Remarks.—The specimens recorded here are specifically indistinguishable from the spores previously described by the writer (de Jersey 1959, p. 356) from the Walloon Coal Measures, the diagnosis being emended principally to include the somewhat greater size range of the Ipswich spores. The two specimens figured (Plate 2, Figure 11 and Plate 1, Figure 20) are respectively from the lower and upper portions of this size range.

Figured specimen (Plate 1, Figure 20).—Slide No. 121, Stage coordinates 5·0, 112·1; diameter 43 microns. Coordinates of lower right-hand corner of cover glass 3·6, 122·2.

Figured specimen (Plate 2, Figure 1).—Slide No. 41, Stage coordinates 12·4, 118·0; diameter 27 microns. Coordinates of lower right-hand corner of cover glass 4·5, 121·8.

Genus VERRUCOSISPORITES (Ibrahim, Potonié and Kremp) Bhardwaj

Verrucosisporites cameroni, new species

Plate 2, Figures 2 and 3

Diagnosis.—Amb triangular to sub-triangular, apices rounded, sides straight or slightly convex. Trilete, laesurae often ill-defined or inconspicuous, where evident extending to the periphery. Diameter (based on 37 measured specimens) 29 to 48 microns. Ornamentation predominantly verrucate, with rounded sub-hemispherical projections 1·5 to 3 microns in diameter, 1 to 3 microns apart. Some of projections in the equatorial region echinate to baculate, 2 to 3 microns in length, 1 to 2 microns in basal diameter. Ornament reduced on priximal face. Exine light yellow to brownish yellow, 1 to 1·5 microns in thickness.

Remarks.—This species has been placed in *Verrucosisporites* rather than in *Acanthotriletes* or *Baculatisporites* because the ornamentation, although including some echinate or baculate projections, consists predominantly of verrucae. This diversity in sculpture is a feature which distinguishes these Ipswich spores from previously described species of *Verrucosisporites.* It is thus quite distinct from species previously described from the Australian Permian (Balme and Hennelly 1956) and the Jurassic of the Walloon Coal Measures (de Jersey 1959). The species is named after the late W. E. Cameron, former Geologist, Geological Survey of Queensland, who carried out detailed geological work in the Ipswich coalfield, leading to the publication of the first detailed geological map of the area (Cameron, 1923).

Holotype (Plate 2, Figure 2).—Slide No. 153, Stage coordinates 11·0, 117·6; diameter 39 microns. Coordinates of lower right-hand corner of cover glass 2·5, 125·6.

Figured specimen (Plate 2, Figure 3).—Slide No. 151, Stage coordinates 10·0, 119·2, diameter 36 microns. Coordinates of lower right-hand corner of cover glass 2·4, 122·8.

Locality of holotype.—Bore N.S. 185 (Ipswich Coalfield), 1583 ft. 0½ in. to 1586 ft. (New Found Out seam).

Genus CINGULATISPORITES (Thomson) Potonié

Cingulatisporites pallidus, new species

Plate 2, Figures 4 and 5

Diagnosis.—Amb rounded triangular to sub-circular. Spore complex, consisting of a central body surrounded equatorially by a thin cingulum 4 to 8 microns wide. Trilete, laesurae extending to junction of central body and cingulum. Total diameter (based on 18 measured specimens) 38 to 50 microns, diameter of body 25 to 43 microns. Exine of body thin (1 micron or less), proximal side smooth, distal side with an indistinct, incomplete reticulum, with rounded lumina 3 to 6 microns in diameter, muri about 1 micron wide and 1 micron high. Cingulum smooth, fragile, very thin (less than 1 micron).

Remarks.—The spores recorded here have been placed in *Cingulatisporites* rather than in *Polypodiaceoisporites* Potonié because the ornamentation of the body exine is indistinctly and incompletely reticulate rather than a well-defined reticulum as in the latter genus. In addition *C. pallidus* has a rounded triangular to sub-circular outline, in contrast to the more sharply triangular outline of *Polypodiaceoisporites.*

A distinctive feature of *C. pallidus* is its thin exine, particularly the exine of the cingulum, which is so thin as to be relatively fragile and broken in most specimens. Other diagnostic characters are the size and body ornamentation. These features enable the species to be distinguished from previously described Australian and overseas species of the genus.

Holotype (Plate 2, Figure 5).—Slide No. 269, Stage coordinatees 19·05, 101·9; diameter 49 microns. Coordinates of lower right-hand corner of cover glass 2·4, 118·4.

Figured specimen (Plate 2, Figure 4).—Slide No. 306, Stage coordinates 11·6, 108·1; diameter 36 microns. Coordinates of lower right-hand corner of cover glass 3·3, 120·6.

Locality of holotype.—Bore N.S. 63 (Ipswich Coalfield), 627 ft. 8½ in. to 630 ft. 1¾ in., Waterstown seam.

Genus PUNCTATOSPORITES Ibrahim

Punctatosporites walkomi, new species

Plate 2, Figures 6 and 7

Diagnosis.—Amb circular, sub-circular or broadly oval. Monlete; laesura, often inconspicuous, extending from two-thirds to full length of spore. Diameter (based on 115 measured specimens) 20 to 38 microns. Exine about 1 micron thick, pale yellow to light brownish yellow, granulate, with projections 0·5 to 1 micron in diameter, about 40 along the equator. Sculpture pattern fairly dense, with projections 1 micron or less apart.

Remarks.—The specimens figured (Plate 2, Figures 6 and 7) show the monolete laesura which is one of the generic characters. The laesurae are relatively inconspicuous in most specimens, and completely lacking in some of them, which resemble the spores figured in all other features. Consequently the latter, apparently alete, spores are also included in the species.

P. walkomi differs from previously described species of *Punctatosporites* in the length and nature of the laesura, size, shape and density of the ornamentation. This form-genus has been recorded mainly from the Carboniferous (Bhardwaj 1957, p. 111) and Triassic (Leschik 1955, p. 27). The species is named after Dr. A. B. Walkom, in recognition of his detailed work on Mesozoic floras of Queensland, in general, and of the Ipswich Coal Measures in particular.

Holotype (Plate 2, Figure 6).—Slide No. 187, Stage coordinates 5·4, 112·1; diameter 29 microns. Coordinates of lower right-hand corner of cover glass 2·7, 116·2.

Figured specimen (Plate 2, Figure 7).—Slide No. 189, Stage coordinates 16·6, 112·4; diameter 27 microns. Coordinates of lower right-hand corner of cover glass 3·1, 121·2.

Locality of holotype.—Bore N.S. 188 (Ipswich Coalfield), 1324 ft. 10½ in. to 1328 ft. 0¼ in., Unnamed seam.

Genus VERRUCOSOSPORITES (Knox) Potonié and Kremp

Verrucososporites ipsviciensis, new species

Diagnosis.—Amb circular to broadly ovate. Monolete, ill-defined laesura often obscured by ornamentation (some specimens apparently alete). Diameter (based on 157 measured specimens) 20 to 35 microns. Exine ornamented by verrucate projections, 1 to 3 microns in diameter, sub-circular to oval, 1 to 2 microns in height. Some of projections coalescing to form rugulae. Sculpture pattern dense (projections about 1 micron apart). Fine hair-like papillae, about 2 microns in length and less than 1 micron in width, arising from the middle of the verrucae in some specimens. Exine light yellow to brownish yellow, about 1 micron in thickness (exclusive of projections).

Remarks.—Many of the specimens included in this species (e.g. Plate 2, figs. 9, 10) are apparently alete, showing no evidence of germinal markings. Because of their similarity in all other features to other specimens (e.g. Pl. 2, fig. 8), which are definitely monolete, the species is included in *Verrucososporites,* this course being considered preferable to proposing a new genus. The apparent absence of a laesura in some specimens may be due to its being obscured by the dense ornamentation, but even where evident, the laesura is inconspicuous or ill-defined. There is appreciable variation in the ornamentation, there being a continuous gradation from specimens with larger projections (2 to 3 microns) to those with smaller verrucae (about 1 micron). Fine hair-like papillae have been observed arising from the middle of the verrucae in some specimens; their absence in other specimens is probably due to slight overmaceration or to such fragile elements being broken off in transport or in processing of the samples.

V. ipsviciensis is readily distinguished from species of the genus previously described from the Permian of Australia (Balme and Hennelly 1956, p. 57) by its size, the nature of the ornament, and the inconspicuous laesura. It is also clearly differentiated from Carboniferous species of *Verrucososporites.*

Holotype (Plate 2, Figure 8.—Slide No. 137, Stage coordinates 11·0, 117·8; dimensions 28 x 25 microns. Coordinates of lower right-hand corner of cover glass 2·6, 119·3.

Figured specimen (Plate 2, Figure 9).—Slide No. 155, Stage coordinates 8·0, 106·9; diameter 25 microns. Coordinates of lower right-hand corner of cover glass 4·8, 120·7.

Figured specimen (Plate 2, Figure 10).—Slide No. 194, Stage coordinates 13·9, 106·5; diameter 22 microns. Coordinates of lower right-hand corner of cover glass 4·8, 120·7.

Locality of holotype.—Bore N.S. 185 (Ipswich Coalfield), 1575 ft. 1½ in. to 1579 ft. 7¾ in. New Found Out seam.

Verrucososporites sp.

Plate 2, Figures 11 and 12

Description.—Amb sub-circular to broadly ovate. Monolete character suggested by longitudinal folds or thinner areas, definite laesura not observed. Diameter (based on 90 measured specimens) 35 to 48 microns. Ornamentation dominantly verrucate with dense sculpture pattern of rounded projections, 2 to 4 microns in diameter, set 1 to 3 microns apart. Some projections, particularly at periphery of spore, bluntly echinate to baculate. Exine (apart from projections) light yellow to light brown, 1 to 1·5 microns in thickness.

Remarks.—The spores recorded here, although considered specifically distinct from *V. ipsviciensis,* have not been given a specific name as most of the specimens examined are relatively poorly preserved. They are distinguished from *V. ipsviciensis* by their larger size and the larger size of the verrucate projections. The monolete character is less in evidence than in that species, but the nature of the ornamentation is so similar that these specimens are also placed in *Verrucososporites.* Their recognition as a species distinct from *V. ipsviciensis* is supported by stratigraphic evidence. The latter species ranges through the Ipswich Coal Measures, while the larger spores recorded here appear to be confined to the Blackstone Formation, at the top of the sequence.

Figured specimen (Plate 2, Figure 11).—Slide No. 76, Stage coordinates 10·1, 116·4; dimensions 48 x 42 microns. Coordinates of lower right-hand corner of cover glass 3·4, 122·4.

Figured specimen (Plate 2, Figure 2).—Slide No. 28, Stage coordinates 14·1, 118·35; dimensions 48 x 42 microns. Coordinates of lower right-hand corner of cover glass 3·5, 121·8.

Division PTERIDOSPERMOPHYTA

Family CORYSTOSPERMACEAE

Genus ALISPORITES (Daugherty) Rouse

Diagnosis (Rouse 1959, p. 314).—"Pollen grains bilaterally symmetrical, with two bladders diametrically opposed, united in the region of the proximal furrow, and with little or no constriction into two distinct bladder units. Marginal cap or crest relatively thin, consisting of two concentric or linear flaps subtending the central furrow, and with well developed margins. Ornamentation of bladders coarsely reticulate in outer regions, grading into fine reticulate or weakly punctate in the area of the proximal furrow. Shape generally

oblong, but varying toward circular or elliptical. Overall range of length 40–300 microns; of width 20–150 microns".

Remarks.—The maceration residues from the Ipswich coals contain abundant disaccate pollens which fit fairly well into the above diagnosis. Some of them also fit, however, into the generic diagnosis of *Pteruchipollenites* Couper (Couper 1958, p. 150), which is as follows:—"Saccate, body of grain longer than broad; bladders attached distally but not markedly so; mesh of reticulate thickenings of bladders less than 3 microns; exine of body thin". The main distinction from *Alisporites* is thus based on the shape of the body (being longer than broad). This criterion, however, cannot be successfully applied to the Ipswich pollens as study of their dimensions has shown that there is a continuous gradation in body outline in some of the species, ranging from longer than broad through circular or sub-circular to somewhat broader than long. Consequently *Alisporites,* which, being originally proposed by Daugherty in 1941, has considerable chronological priority over *Pteruchipollenites,* has been used as a broadly defined genus in which to place the Ipswich pollens described below.

The species described by Rouse (1959, pp. 316, 317) were considered by him to have coniferous affinities, and this is in conformity with the association with coniferous macro-fossils, and the age of the microflora (Upper Jurassic). In the Ipswich species, on the other hand, the relationship is considered to be mainly with the Pteridosperms rather than with the Conifers. This was suspected originally because of the abundance of Pteridosperm leaf-fossils (notably the genus *Dicroidium*) in the Ipswich Coal Measures, which parallels the abundance of disaccate pollen in the coals. It has been supported by the recent work of Townrow, who has studied the pollen of *Pteruchus,* a microsporangiate organ of Pteridosperm affinity which is present in the Ipswich Coal Measures, and also in other Triassic sediments in the Southern Hemisphere. Townrow has brought forward convincing evidence, based on cuticle structure and association that *Pteruchus africanus, P. dubius* and *P. simmondsi* are respectively the pollen grains of *Dicroidium odontopteroides, D. feistmanteli* and *Xylopteris elongata* (Townrow, personal communication).

Townrow (1962) has also found that the presence of a colpus is a distinctive feature of *Pteruchus* and has emphasised its importance in distinguishing that genus from other disaccate pollens. This character has not been previously emphasised, and was not, for example, considered by Couper (1958) in defining *Pteruchipollenites.* The colpus is evident only in well preserved, favourably presented grains and this probably explains the lack of previous general recognition of its diagnostic importance. On learning of the significance of this colpus character (from information kindly supplied by J. A. Townrow, in advance of publication) the writer made a search for its presence in the Ipswich pollens recorded here. Although many of the specimens are poorly preserved or unfavourably oriented, a significant proportion have the colpus clearly defined (e.g. Plate 3, Figure 3). Such grains are thus considered to be closely comparable with *Pteruchus,* and consequently are regarded as having Pteridospermous affinities. Accordingly they have tentatively been placed in the Corystospermaceae, as the heading above indicates.

The only disaccate pollens previously described from the Triassic of Australia are two species of *Pityosporites* proposed by Hennelly (1958)—*Pityosporites nigracristatus* and *P. reticulatus.* Regarding their relationship to *Pteruchus* the writer is indebted to J. A. Townrow (Personal communication dated No. 5th, 1961) for the following remarks:—"Both species *might* be of a *Pteruchus* species, but if so, considerably extend the range of pollen known from *Pteruchus* at present. In my opinion they are more likely to be distinct, in the case of *P. nigracristatus* appearing to lack a colpus, and in *P. reticulatus* having a different corpus shape, and corpus width saccus height ratio. However, since it is not clearly stated which views are figured, and since the information given is, in places, scanty, no definite view is possible in my opinion". Comparison with the Ipswich pollens supports these remarks, and it is considered that both Hennelly's species are distinct from the species described here.

The use of the generic name *Pityosporites* for these species by Hennelly is an example of its application as a broadly defined form genus (Potonié 1958, p. 56) in recording bisaccate pollen grains of uncertain affinity. Rouse (1959, p. 315) regards the distinction between *Alisporites,* on the one hand, and *Pityosporites* and other coniferous pollens, on the other, as based on the distal inclination of the bladders and their obvious attachment to a central body in the latter group. However, this criterion, which is not explicitly mentioned in his emended diagnosis, is difficult to apply, as the species figured by Rouse show some distal inclination of the bladders, however slight, and the permissible limit of distal inclination within *Alisporites* is difficult to determine. In the present investigation *Alisporites* has been interpreted more widely, to include grains with appreciable distal inclination, such as those, for example, of *Pteruchus africanus.* This procedure has been followed, because, as indicated by Potonié (1958, pp. 56, 57) the genotype of *Pityosporites* is poorly known and the genus is in other respects unsatisfactory. Consequently *Alisporites* (broadly interpreted) is here regarded, on present knowledge, as preferable to *Pityosporites* as a generic name for the Ipswich pollens. Should further evidence come to hand on the generic status of *Pityosporites,* a re-appraisal of the position would become necessary.

The terminology used in the following specific descriptions is that of Townrow (1962):—

Alisporites australis, new species

Plate 2, Figure 14; Plate 3, Figures 3 and 4

Diagnosis.—Grains disaccate, total span (based on 64 measured specimens), 60 to 110 microns. Corpus longer than wide (polar view), ratio length to width greater than 5 to 4. Length of corpus 38 to 76

microns. Colpus (observed in well preserved, suitably oriented specimens), extending full length of corpus. Sacci not or scarcely overlapping on to proximal surface, roots of sacci markedly offset distally. Sacci as deep as corpus, or a little less. Ornament on sacci: brochi about 3 microns in diameter, muri about 1 micron wide. Ornament on corpus indistinct to faintly reticulate. Corpus and sacci without marked thickening, light yellow to brownish yellow, thickness about 1 to 1·5 microns.

Remarks.—The pollens recorded here resemble closely those of *Pteruchus africanus* Thomas and many of the grains of *A. australis* are regarded as probably identical with that species. (J. A. Townrow, personal communication dated 23-2-62, considers that the name of this, the type species of *Pteruchus,* should be *P. johnstoni* (Feistmantel) Townrow rather than *P. africanus* Thomas).

The writer is also indebted to J. A. Townrow for suggesting criteria, notably based arbitrarily on the length/width ratio of the corpus, for distinguishing the species from other *Pteruchus*-type pollens. Thus *A. australis* differs from pollen of the *Pteruchus simmondsi* type (cf. Plate 3, Figure 1), which has a more rounded corpus (ratio length to width less than 5 to 4); it also differs from pollen of the *P. dubius* type (cf. Plate 2, Figure 13) which has a more oval outline, with corpus no longer than the sacci.

The holotype (Plate 3, Figure 3) has been selected because of its well preserved colpus; other specimens resemble it in all other respects and the colpus has evidently not been observed in them because of unfavourable presentation or poor preservation. The presence of a colpus clearly distinguishes *A. australis* from the species previously described by Rouse (1959, p. 316) and Daugherty (1941, p. 98). It also distinguishes it from *A. parvus,* n.sp., described below

Holotype (Plate 3, Figure 3).—Slide No. 31, Stage coordinates 20·55, 119·0; total span 68 microns. Coordinates of lower right-hand corner of cover glass 4·3, 123·6.

Figured specimen (Plate 2, Figure 14).—Slide No. 107, Stage co-ordinates 10·1, 108·5; total span 77 microns. Coordinates of lower right-hand corner of cover glass 0·1, 121·8.

Figured specimen (Plate 3, Figure 4).—Slide No. 11, Stage coordinates 10·55, 106·4; total span 81 microns. Coordinates of lower right-hand corner of cover glass 2·6, 122·6.

Locality of holotype.—Bore N.S. 176 (Ipswich coalfield), 501 ft. 0½ in. to 507 ft., Bluff seam.

Alisporites sp. 1

Plate 3, Figure 1

Remarks.—The pollen grains recorded under this heading differ from *A. australis* in being somewhat larger than and extending beyond the size range of, typical specimens of that species, in having a more rounded corpus (ratio of length to width less than 5 to 4) and a distinct overlap of the sacci on the cappa, and finally in the corpus having a rather strong cuticle and distinct cappa ornament. In all these features they resemble the pollen of *Pteruchus simmondsi* (J. A. Townrow, personal communication dated 23-2-62). As relatively few specimens of this type were observed, they have not been defined and named as another species of *Alisporites.* However, it is hoped, in further work in Queensland Triassic microfloras, to study the distinction from *A. australis* and, if possible, to define another species based on such pollen of the *P. simmondsi* type.

Figured specimen (Plate 3, Figure 1).—Slide No. 182, Stage coordinates, 5·0, 102·9; total span 112 microns. Coordinates of lower-right hand corner of cover glass 4·1, 119·2.

Alisporites sp. 2

Plate 2, Figure 13

Remarks.—These pollens differ from *A. australis* in the overall outline of the grain, which is nearly rectangular, with the corpus no longer than the sacci, and in the distinct proximal overlap of the sacci on the corpus. They are also different from those of *Alisporites sp.* 1 in lacking the strong ornament on the cappa, and in the overall outline of the grain. In these features they thus resemble the pollen of *Pteruchus dubius* (J. A. Townrow, personal communication dated 23-2-62). As in the case of *Alisporites sp.* 1 above, such pollens of the *P. dubius* type have not been defined and named as another species of *Alisporites,* but it is hoped that this will be possible with further work on the Triassic microfloras of Queensland.

Figured specimen (Plate 2, Figure 13).—Slide No. 85, Stage coordinates 5·5, 104·5; total span 85 microns. Coordinates of lower right-hand corner of cover glass 2·8, 118·9.

Division CONIFEROPHYTA

Genus ALISPORITES (Daugherty) Rouse

Alisporites parvus, new species

Plate 4, Figures 1, 2, 3 and 4

Diagnosis.—Grains disaccate, total span (based on 78 measured specimens) 42 to 59 microns. Corpus usually sub-circular, varying from slightly wider than long to slightly longer than wide. Length of corpus 22 to 48 microns. Corpus with a leptoma (tenuitas). Cappa smooth to faintly reticulate, about 1 micron in thickness. Sacci opposite or with slight distal inclination, overlapping corpus except for a median portion 4 to 17 microns across. Length of sacci approximately equal to length of corpus, breadth 15 to 29 microns. Sacci ornamented with a fine reticulum, brochi 1 to 2 microns. Exine of sacci light yellow to brownish yellow, about 1 micron in thickness.

Remarks.—*A. parvus* is distinguished from the species of *Alisporites* described above by the absence of a definite colpus. Thus the thinning of the corpus in the specimen illustrated in Plate 4, Figure 2, and the tear in the corpus in another specimen (Plate 4, Figure

3) are considered to be features associated with a leptoma, rather than with a definite colpus (e.g. Plate 3, Figure 3 for comparison). The species also differs from the species of *Pteruchus* in being generally smaller in overall size, as well as in lacking a colpus. Accordingly it is considered by J. A. Townrow (personal communication dated 23-2-62) to be more likely to have affinities with the Conifers than with the Corystospermaceae.

The only previously described species with which *A. parvus* is possibly comparable is *A. minutus* Rouse (Rouse 1959, p. 316). The species, however, differ in saccus attachment, Rouse's species having a greater overlap of the sacci, and also apparently a more oval corpus shape.

Holotype (Plate 4, Figure 1).—Slide No. 107, Stage coordinates 9·5, 112·15; total span 57 microns. Coordinates of lower right-hand corner of cover glass 0·0, 121·8.

Figured specimen (Plate 4, Figure 2).—Slide No. 249, Stage coordinates 16·8, 118·8; total span 52 microns. Coordinates of lower right-hand corner of cover glass 3·3, 116·5.

Figured specimen (Plate 4, Figure 3).—Slide No. 247, Stage coordinates 18·55, 108·5; total span 52 microns. Coordinates of lower right-hand corner of cover glass 3·3, 116·5.

Figured specimen (Plate 4, Figure 4).—Slide No. 255, Stage coordinates 4·9, 108·1; total span 55 microns. Coordinates of lower right-hand corner of cover glass 2·5, 120·3.

Locality of holotype.—Bore N.S. 92 (Ipswich coalfield), 279 ft. 9 in. to 284 ft. 3 in., Four Feet seam.

Genus PLATYSACCUS (Naumova) Potonié and Klaus

Platysaccus queenslandi, new species

Plate 4, Figures 5 and 6

Diagnosis.—Grains disaccate, total span (based on 20 measured specimens) 55 to 91 microns. Corpus sub-circular, diameter 22 to 41 microns. Corpus smooth or faintly ornamented, dark brown, about 2 microns in thickness. Sacci opposite or with slight distal inclination, overlapping corpus except for a median portion, up to 4 microns across, extending greater part of depth of corpus. Sacci sub-circular, distinctly inflated, with maximum depth about 1·5 times depth of corpus. Ornament on sacci obscure to distinct (brochi 1 to 3 microns in diameter, muri about 1 micron). Exine of sacci light yellow, about 1 micron in thickness.

Remarks.—This species has been placed in *Platysaccus* rather than in *Podocarpidites* (Cookson) Potonié as the saccus reticulum tends to be coarser than in that genus, also the corpus outline is sub-circular, not oval as in the type-species of *Podocarpidites,* and finally in the marked overlap of the sacci *P. queenslandi* closely resembles the genotype of *Platysaccus, P. papilionis.* It differs from the latter species in having less inflated sacci, and also a thicker corpus.

Holotype (Plate 4, Figure 5).—Slide No. 25, Stage coordinates 16·9, 111·8; total span 88 microns. Coordinates of lower right-hand corner of cover glass 3·8, 119·8.

Figured specimen (Plate 4, Figure 6).—Slide No. 4, Stage coordinates 8·45, 99·9; total span 74 microns. Coordinates of lower right-hand corner of cover glass 2·4, 116·3.

Locality of holotype.—Bore N.S. 186 (Ipswich coalfield), 1486 ft. 2½ in. to 1,491 ft. 9 in., Aberdare seam.

? Division PTERIDOSPERMOPHYTA

Indeterminate Monosaccate pollen

Plate 3, Figure 6.

Remarks.—The specimen figured (Plate 3, Figure 6) was at first considered to be an abnormal specimen of *A. australis,* but is now regarded as more likely to be a normal specimen of monosaccate pollen, exhibiting a well defined colpus. On account of its rarity it is not further described here. J. A. Townrow (personal communication dated 23/2/62) suggests similarity to the Permian Pteridosperms, *Schuetzia anomala, Thuringia callipteroides,* and *Dictyothalamus schrollianus.*

Figured specimen (Plate 3, Figure 6).—Slide No. 20, Stage coordinates 12·8, 116·8; total span 92 microns. Coordinates of lower right-hand corner of cover glass 2·8, 123·3.

Division PTERIDOSPERMOPHYTA
Family CAYTONIACEAE
Genus VITREISPORITES Leschik

Remarks.—Potonié (1960, p. 77) has shown that the generic name *Caytonipollenites* Couper 1958 is a synonym of *Vitreisporites* Leschik 1955. Accordingly the two species previously described by the writer from the Rosewood coalfield as *Caytonipollenites contectus* and *C. subtilis* (de Jersey 1959, p. 361) are here transferred to Leschik's genus.

Vitreisporites contectus (de Jersey), new combination

Plate 4, Figure 7.

Caytonipollenites contectus de Jersey 1959, Qld. Govt. Min. J. **60,** 361, pl. 3, figs 2, 3.

Emended diagnosis.—Pollen grain disaccate. Corpus oval in polar view; longer than broad, exine smooth, very thin (less than 1 micron). Total span of grain (based on 73 measured specimens) 22 to 47 microns; length of corpus 15 to 32 microns, breadth of corpus 13 to 28 microns, average ratio of length to breadth 1·2. Sacci large in relation to size of corpus, attached with a slight distal inclination. Sacci covering corpus except for a narrow median longitudinal portion, 1 to 2 microns in width, extending complete length of corpus. Sacci smooth or with faint reticulate ornament, less than 1 micron in thickness.

Remarks.—The Ipswich specimens recorded here are specifically indistinguishable from those previously described by the writer from the Walloon Coal

Measures as *Caytonipollenites contectus* (de Jersey 1959, p. 361). The original diagnosis has been emended slightly to cover the slightly greater variation found as a result of study of a larger number of specimens. In the Ipswich pollens the average ratio of length to breadth of corpus is slightly less (1·2 as against 1·5) but this may be due to the greater number of specimens studied from the Ipswich samples, enabling a more accurate determination of this ratio. In some specimens the sacci exhibit a faint, finely reticulate ornamentation (mesh of reticulum less than 1 micron).

V. contectus differs from *V. signatus* Leschik from the European Keuper (Leschik 1955, p. 53) (of which *Caytonipollenites pallidus* (Reissinger) is a synonym) in having a greater overlap of the sacci over the corpus, less marked saccus ornamentation, and in the absence of a weak trilete tetrad scar observed in some of the European specimens.

Figured specimen (Plate 4, Figure 7).—Slide No. 182; Stage coordinates 15·55, 105·9; total span 32 microns. Coordinates of lower right-hand corner of cover glass 4·1, 119·2.

Vitreisporites subtilis (de Jersey), new combination

Plate 4, Figures 8 and 9.

Caytonipollenites subtilis de Jersey, 1959, Qld. Govt. Min. J. **60,** 381, pl. 3, fig. 4.

Emended diagnosis.—Pollen grains disaccate. Corpus oval in polar view, longer than broad, exine smooth, very thin (less than 1 micron). Total span of grain (based on 59 measured specimens) 22 to 48 microns, length of corpus 14 to 30 microns, breadth of corpus 12 to 28 microns, average ratio of length to breadth 1·2. Sacci about same size as corpus, opposite or attached with slight distal inclination. Sacci overlapping corpus except for a median portion 5 to 15 microns in width, extending length of corpus. Sacci smooth to faintly reticulate (mesh 1 micron or less), less than 1 micron in thickness.

Remarks.—These pollen grains are specifically identical with those previously described by the writer from the Walloon Coal Measures as *Caytonipollenites subtilis* (de Jersey 1959, p. 361). The diagnosis has been emended slightly to cover the slightly greater range of variation in the Ipswich specimens. *V. subtilis* differs from *V. contectus,* described above, in having sacci with a lesser overlap on the corpus; it is distinguished from *V. signatus* Leschik by the lack of marked saccus ornament and of a short trilete tetrad-scar observed in some of the European specimens.

Figured specimen (Plate 4, Figure 8).—Slide No. 31, Stage coordinates 8·05, 106·8; total span 29 microns. Coordinates of lower right-hand corner of cover glass 4·3, 123·6.

Figured specimen (Plate 4, Figure 9).—Slide No. 21, Stage coordinates 7·45, 114·05; total span 31 microns. Coordinates of lower right-hand corner of cover glass 3·9, 120·2.

DISACCATE POLLEN GRAINS (*INCERTAE SEDIS*)

Genus CHORDASPORITES Klaus

Remarks.—The genus *Chordasporites* has recently been proposed by Klaus (1960, p. 157) for disaccate pollen grains with a prominent transverse ridge (chorda) on the corpus. The discovery of a species in the Ipswich Coal Measures may be of stratigraphic significance in the correlation of the Triassic of the Ipswich basin with the European sequence, as in Europe the genus is restricted to the Muschelkalk and Carnic (lower middle Keuper).

Chordasporites australiensis, new species

Plate 4, Figures 10 and 11.

Diagnosis.—Disaccate pollen grains, total span (based on 28 measured specimens) 60 to 98 microns. Corpus broader than long, sub-circular or longer than broad, length 32 to 64 microns, breadth 30 to 58 microns, ratio length to breadth 0·7 to 1·4. Exine of corpus smooth to faintly reticulate, light yellow, approximately 1 micron in thickness, without differential thickening. Prominent transverse ridge (chorda), extending total breadth, or almost total breadth, of corpus. Chorda 4 to 8 microns in width, with non-sinuous margins, without adjacent patches of thinner exine. Sacci opposite or with slight distal inclination, overlapping corpus except for a narrow median portion. Sacci with semi-circular outline, approximately equal to body in size, ornamented with faintly to distinctly marked reticulum, mesh 1·5 to 3 microns, light yellow, exine about 1 micron in thickness.

Remarks.—*C. australiensis* is distinguished from the only described species, the genotype *C. singulichorda* Klaus (Klaus 1960, p. 158) by its thinner corpus, its lack of differential thickening of the corpus, and the absence of sinuous margins of the chorda and of thinner portions of the exine adjacent to the chorda.

Holotype (Plate 4, Figure 10).—Slide No. 190, Stage coordinates 18·4, 117·0; total span 78 microns, Coordinates of lower right-hand corner of cover glass 2·3, 122·3.

Figured specimen (Plate 4, Figure 11).—Slide No. 208, Stage coordinates 15·45, 102·1; total span 71 microns. Coordinates of lower right-hand corner of cover glass 3·1, 118·7.

Locality of holotype.—Bore N.S. 188 (Ipswich Coalfield), 1,324 ft. 10½ in. to 1,328 ft. 0¼ in., Unnamed seam.

Monocolpate Pollen Grains

Remarks.—Under this heading are included pollen grains, more or less oval in outline, with a single longitudinal furrow or colpus, such as are produced by the Ginkgoales, Cycadophyta and some Pteridosperms. Because of the generalised nature of these grains, some at least of the species described below should be regarded as form-species, and are likely to include more than one natural species.

Genus GINKGOCYCADOPHYTUS Samoilowitz

Remarks.—Some of the species of this genus described below were previously included in the genus *Entylissa* Naumova. Potonié and Kremp (1954, p. 181 and 1958, p. 186) regard the generic name *Entylissa* as "inapplicable" as no genotype was selected. This view is followed here, and *Ginkgocycadophytus,* the oldest legitimate generic name, is thus applied to the Ipswich pollens (which also include some of the Walloon species previously placed in *Entylissa*).

Ginkgocycadophytus nitidus (Balme), new combination

Plate 5, Figures 1, 2 and 3.

Entylissa nitidus Balme, 1957, C.S.I.R.O. Fuel Research T.C. 25, p. 30, pl. 6, figs. 78-80.

Entylissa nitidus de Jersey, 1959, Qld. Govt. Min. **60,** 359, pl. 2, fig. 14.

Emended diagnosis.—Amb elongated oval to broadly oval. Monocolpate, furrow extending full length of the distal surface, uniform in width or slightly expanded at the extremities. Length (based on 145 measured specimens), 20 to 55 microns, breadth 11 to 36 microns. Exine smooth or faintly scabrate, 1 micron or less in thickness.

Remarks.—The Ipswich specimens recorded here show variation in three characters—size, shape and the nature of the furrow. They range up to 55 microns, thus including larger specimens excluded from Balme's original diagnosis (22 to 30 microns) (e.g. Plate 5, Figure 3); the shape varies from broadly oval (ratio length to breadth 1·3, e.g. Plate 5, Figure 1) to more elongate (e.g. Plate 5, Figures 2 and 3) and finally the furrow is either uniform in width (e.g. Plate 5, Figure 2) or else expanded at one or more extremities. As the Ipswich spores show continuous variation in all these characters, it has not been possible to subdivide them into more restricted groups, and consequently they have all been included in *G. nitidus* and Balme's original diagnosis (Balme 1957, p. 30) has been emended to allow for this wider variation. It is considered that this emendation will make *G. nitidus* more useful for recording these pollens, which are common in the Mesozoic of Queensland.

Figured specimen (Plate 5, Figure 1).—Slide No. 119, Stage coordinates 18·95, 110·3; dimensions 34 x 27 microns. Coordinates of lower right-hand corner of cover glass 3·8, 120·8.

Figured specimen (Plate 5, Figure 2).—Slide No. 120, Stage coordinates 12·55, 111·6; dimensions 24 x 14 microns. Coordinates of lower right hand corner of cover glass 2·6, 121·4.

Figured specimen (Plate 5, Figure 3).—Slide No. 120, Stage coordinates 4·6, 118·5; dimensions 41 x 20 microns.

Ginkgocycadophytus crassimarginis (de Jersey), new combination

Plate 5, Figure 4

Entylissa. crassimarginis de Jersey Qld. Govt. Min. J, **60**, 361, Pl. 2, figs. 15, 16.

Diagnosis (de Jersey 1959, p. 361).—Amb elongated oval. Monocolpate furrow extending full length of the distal surface, each furrow margin thickened for an average width of about 3 microns. Length (based on 63 measured specimens) 20 to 45 microns, width 10 to 31 microns. Exine smooth, 1 micron or less in thickness.

Remarks.—These pollens are specifically indistinguishable from the Jurassic specimens previously described by the writer as *Entylissa crassimarginis.* The species shows variation in the nature of the furrow; this may be either uniform in width (e.g. de Jersey 1959, pl. 2, figs. 15, 16) or expanded at one or more extremities (pl. 5, fig. 4 of the present paper) and the specimens show continuous variation in this character.

Figured specimen (Plate 5, Figure 4).—Slide No. 33, Stage coordinates 10·05, 110·9; dimensions 36 x 25 microns. Coordinates of lower right-hand corner of cover glass 2·8, 121·0.

Ginkgocycadophytus granulatus, new species

Plate 5, Figures 5, 6 and 7

Diagnosis.—Amb elongated oval. Monocolpate, furrow extending full length of distal surface, often expanded at extremities. Length (based on 30 measured specimens) 24 to 55 microns, width 14 to 28 microns. Exine about 1 micron thick, light yellow. Ornamentation dominantly granulate, with rounded projections 0·5 to 1 micron in diameter, to papillate. Sculpture pattern fairly dense, with projections 1 micron or less apart.

Remarks.—This species is distinguished from *G. nitidus* (Balme by its granulate-papillate ornamentation. In his original diagnosis (1957, p. 30) Balme described *G. nitidus* as "smooth or faintly granulate"; however the granulate ornament of *G. granulatus* is quite distinct, the granulations showing a gradation to papillate projections, visible at the periphery, and in the Ipswich material the distinction between the two species is quite clear. The three specimens figured (Plate 5, Figures 5, 6 and 7) show the variation in size, ornament and nature of the furrow.

Holotype (Plate 5, Figure 5).—Slide No. 230, Stage coordinates 15·6, 112·7; dimensions 45 x 20 microns. Coordinates of lower right-hand corner of cover glass 4·0, 118·9.

Figured specimen (Plate 5, Figure 6).—Slide No. 40, Stage coordinates 14·6, 108·3; dimensions 46 x 20 microns. Coordinates of lower right-hand corner of cover glass 4·3, 122·8.

Figured specimen (Plate 5, Figure 7).—Slide No. 231, Stage coordinates 13·1, 109·3; dimensions 42 x 24 microns. Coordinates of lower right-hand corner of cover glass 3·2, 115·5.

Locality of holotype.—Bore N.S. 156 (Ipswich Coalfield), 174 ft. 0¼ in. to 181 ft. 2½ in., Cochrane seam.

Ginkgocycadophytus adjectus, new species

Plate 5, Figures 8, 9 and 10

Diagnosis.—Amb oval, extremities rounded to bluntly pointed. Monocolpate, furrow extending full length of distal surface. Furrow margins overlapping for a width of 4 to11 microns; area of overlap extending from about two-thirds to whole length of grain. Length (based on 55 measured specimens) 30 to 53 microns, width 14 to 31 microns. Exine smooth to scabrate, 1 to 1·5 microns in thickness, light yellow to brownish yellow.

Remarks.—The distinctive feature of this species is the marked overlap of the furrow margins, which feature has not been observed in the case of *G. nitidus* or other species described by Balme and the writer. The variations in the width and length of overlap are illustrated; in the holotype (Plate 5, Figure 8) the margins overlap for their whole length and for a considerable width, in the other two figured specimens they overlap for a lesser width and for about two-thirds of their length. There is continuous variation in this feature in the Ipswich specimens. The species has been placed in *Ginkgocycadophytus,* even at the risk of extending the genus slightly, as the differences between it and the other species are regarded as of specific, not generic significance.

Holotype (Plate 5, Figure 8).—Slide No. 306, Stage coordinates 8·6, 112·4; dimensions 39 x 20 microns. Coordinates of lower right-hand corner of cover glass 3·3, 120·6.

Figured specimen (Plate 5, Figure 9).—Slide No. 237, Stage coordinates 7·05, 111·6; dimensions 42 x 20 microns. Coordinates of lower right-hand corner of cover glass 3·5, 117·6.

Figured specimen (Plate 5, Figure 10).—Slide No. 243, Stage co-ordinates 14·9, 106·0; dimensions 32 x 15 microns. Coordinates of lower right-hand corner of cover glass 2·3, 120·1.

Locality of holotype.—Bore N.S. 48 (Ipswich Coalfield), 764 ft. 4½ in. to 775 ft. 7¾ in., Haighmoor Bottom seam.

Division CONIFEROPHYTA

Family ARAUCARIACEAE

Genus ARAUCARIACITES Cookson

Araucariacites sp.

Plate 5, Figure 11

Description.—Outline circular or sub-circular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Diameter (based on 58 measured specimens) 45 to 95 microns (mean about 65 microns). Ornamentation granular, with projections 1 to 2 microns in diameter, to papillate. Sculpture pattern fairly dense, with projections 1 to 2 microns apart. Exine about 1 micron in thickness, pale yellow to light brownish yellow.

Remarks.—The specimens recorded here are distinguished from *Araucariacites australis* Cookson, originally described from the Tertiary of Kerguelen (Cookson 1947. p. 130) by the larger size of the granulations (which are also more distinctly separated) and by the presence of papillae. They also differ similarly from the pollens described by Couper (1958, p. 151) as *Araucariacites australis* from the Mesozoic of Great Britain. The Ipswich pollens show appreciable variation amongst themselves, with respect to size, thickness and ornamentation, and it is not yet clear whether more than one species is represented. Because of this a new specific name has not been proposed for them, although they are regarded as distinct from *A. australis.*

Figured specimen (Plate 5, Figure 11).—Slide No. 109, Stage co-ordinates 20·5, 107·2; dimensions 64 x 60 microns. Co-ordinates of lower right-hand corner of cover glass 3·8, 119·7.

Division CONIFEROPHYTA

Genus LARICOIDITES Potonié, Thomson and Thiergart

Laricoidites reidi (de Jersey), new combination

Plate 6, Figure 6

Inaperturopollenites reidi de Jersey, 1959, Qld. Govt. Min. J. **60**, 362, pl. 3, fig. 7.

Diagnosis (de Jersey 1959, p. 362).—Outline circular or sub-circular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Diameter (based on 156 measured specimens) 60 to 112 microns (average about 82 microns). Exine smooth, thin, about 1 micron in thickness), frequently folded, light brownish yellow to almost colourless.

Remarks.—The species *Inaperturopollenites reidi,* described by the writer from the Rosewood coals (de Jersey 1959, p. 362) is here transferred to *Laricoidites.* Potonié (1958, pp. 76-78) indicates that *Laricoidites* differs from *Inaperturopollenites* in being larger and having a smooth exine, in contrast to the more strongly infra-punctate exine of the latter genus. Application of both these criteria supports the transfer of the species to *Laricoidites.* The writer considers that, in view of the variation evident in such Mesozoic pollens, the distinction between the genera may be difficult to maintain; if they are ultimately merged or if doubt exists as to the placing of a particular species the name *Laricoidites* is preferable as it has chronological priority over *Inaperturopollenites.*

The Ipswich specimens recorded here resemble in all respects those previously described from the Rosewood coalfield. The species is relatively rare in the Ipswich coals, in contrast to its great abundance in the Walloon Coal Measures. There is a general similarity to the genotype, *L. magnus* (Potonié), but in view of the wide separation, both in place and time, between the species, these Triassic Ipswich pollens have not been identified with the latter species, which was described from the Tertiary of Germany.

Figured specimen (Plate 6, Figure 6).—Slide No. 88, Stage co-ordinates 10·0, 112·35; dimensions 92 x 84 microns. Co-ordinates of lower right-hand corner of cover glass 5·0, 126·2.

Genus CALLIALASPORITES Sukh Dev

Callialasporites denmeadi, new species

Plate 6, Figures 2 and 3

Diagnosis.—Equatorial contour circular to sub-circular. Total diameter (based on 7 measured specimens) 66 to 92 microns. Pollen grain complex, consisting of a sub-circular central body (corpus) surrounded distalo-equatorially by a saccus, which is fairly uniform in width. No germinal aperture or tetrad markings observed. Diameter of corpus 48 to 74 microns. Exine of corpus 1 to 2 microns thick, light brownish yellow to dark brown, indistinctly reticulate with lumina 5 to 6 microns in diameter, 1 micron in height and 1 micron in width. Saccus 7 to 20 microns wide, with regularly radiating folds or ridges about 1 micron in width, otherwise smooth; outer margin entire, pale yellow to colourless, 1 micron or less in thickness.

Remarks.—Although this species is relatively rare, and only seven specimens have been observed, its morphology is sufficiently distinctive to warrant the proposal of a new specific name. Characteristic features are the reticulate ornamentation of the corpus, regularly radiating folds of the saccus and the entire margin of the latter. These features enable it to be distinguished from the three species of the genus described by Balme (1957, pp. 32, 33) from the Mesozoic of Western Australia (*C. dampieri, C. segmentatus* and *C. trilobatus*). *C. dampieri* and *C. segmentatus* have been recorded by the writer (de Jersey 1959, pp. 362, 363) from the Jurassic of the Rosewood coalfield (under the generic name *Zonalapollenites,* which being a synonym of *Tsugaepollenites* is an inappropriate generic name for these pollens).

The species is named after Mr. A. K. Denmead, Chief Geologist of the Geological Survey of Queensland, in recognition of his work on the geology of the Ipswich Coalfield.

Holotype (Plate 6, Figure 2).—Slide No. 259, Stage coordinates 4·1, 108·7; diameter 70 microns. Coordinates of lower right-hand corner of cover glass 3·1, 120·3.

Figured specimen (Plate 6, Figure 3).—Slide No. 247, Stage coordinates 19·05, 102·8; diameter 78 microns. Coordinates of lower right-hand corner of cover glass 4·0, 120·4.

Locality of holotype.—Bore N.S. 80 (Ipswich coalfield), 768 ft. 3½ in. to 773 ft. 8¼ in. Fiery seam.

? Division CONIFEROPHYTA

Genus PILASPORITES Balme and Hennelly

Remarks.—Potonié (1960, p. 84) distinguishes *Pilasporites* from other inaperturate genera, such as *Laricoidites, Inaperturopollenites* and *Psophosphaera* by its thicker exine. This procedure is followed here, and thick walled, inaperturate pollens in the Ipswich coals are described below as a new species, *Pilasporites fuscus.*

Pilasporites fuscus, new species

Plate 6, Figures 4 and 5

Diagnosis.—Outline sub-circular to broadly oval. No germinal mechanism or tetrad markings visible. Diameter (based on 23 measured specimens) 50 to 109 microns. Exine smooth, uniformly thick (about 3 to 5 microns), dark brown or dark reddish brown.

Remarks.—*P. fuscus* is characterised by its thick exine and dark brown colour in transmitted light, which readily distinguish it from other smooth, inaperturate pollens in the Ipswich coals, recorded above as *Laricoidites reidi.* The above diagnosis covers a large size range (50 to 109 microns), but closer definition of species is not possible in the absence of ornamentation and germinal markings. *P. fuscus* differs from the genotype, *P. calculus,* from the Permian of New South Wales and Tasmania, in lacking differential thickening of the exine, and also in lacking granulate or micro-reticulate ornamentation. It is considerably larger than the other Permian species, *P. plurigenus* (size range 12 to 36 microns).

Holotype (Plate 6, Figure 4).—Slide 247, Stage coordinates 6·0, 102·1; dimensions 62 x 53 microns. Coordinates of lower right-hand corner of cover glass 3·3, 116·5.

Figured specimen (Plate 6, Figure 5).—Slide No. 106, Stage coordinates 8·6, 113·5; dimensions 63 x 48 microns. Coordinates of lower right-hand corner of cover glass 2·1, 119·0.

Genus TENUISACCITES, new genus

The generic name *Tenuisaccites* is proposed for isolated fossil pollen grains having the following characters:—

Amb circular to ovate. Pollen grain complex, consisting of a relatively thick ovate central body (corpus) surrounded distalo-equatorially by a bladder (saccus). Grains alete, without germinal aperture or tetrad markings. Exine of corpus moderately thick, with indistinct granulate or verrucate ornamentation. Saccus very thin, fragile, smooth or with faint fine ornamentation, without radiating folds or ridges and lacking a distinct reticulum.

Genotype.—The new species *Tenuisaccites fragilis,* described below.

Remarks.—Characteristic features of *Tenuisaccites,* which readily distinguish it from other genera of alete, monosaccate pollen, are the thin, fragile saccus and the (by contrast) relatively thick, oval corpus. Thus it differs from *Tsugaepollenites* in lacking the radiating folds on the saccus typical of that genus and in having an oval, not a circular, corpus. The Carboniferous genus *Florinites* has a much thinner, more circular corpus and a saccus with a well-defined reticulum. *Tenuisaccites* also differs from the saccate forms described by Leschik (1955) in that the latter have a distinct cingulum at the junction of the "zona" (or saccus) and the corpus. Finally, it is distinguished

from *Callialasporites,* recently proposed by Sukh Dev (1961, p. 48), by the corpus being relatively thicker and more distinctly oval than in that genus, as well as in having a much thinner saccus.

Tenuisaccites fragilis, new species

Plate 5, Figure 12; Plate 6, Figure 1

Diagnosis.—Amb ovate; outline frequently incomplete owing to fragile nature of saccus. Total diameter (based on 23 measured specimens) 53 to 95 microns. Pollen grain complex, consisting of a broadly ovate corpus surrounded distalo-equatorially by a saccus. No definite germinal aperture or tetrad markings observed; longitudinal folds or cracks may simulate monosulcate dehiscence. Mean dimensions of corpus 50 x 36 microns. Exine of corpus about 2 to 3 microns thick, light brownish yellow to dark brown, indistinctly granulate to verrucate with closely packed projections 1 to 3 microns in diameter. Saccus extending for a width of 10 to 30 microns beyond corpus, very thin (less than 1 micron), fragile, frequently broken, pale yellow to colourless, with faint, fine, closely packed granular ornament (projections 0·5 to 1 micron), outer margin entire or with occasional papillate projections. Saccus without coarse reticulum or radiating folds.

Remarks.—*T. fragilis* is readily distinguished from other species of monosaccate pollen, such as *Callialasporites denmeadi* described above, and also the other Mesozoic species of *Callialasporites*. Owing to the fragile nature of the saccus, relatively complete specimens are rare, and grains with broken, fragmentary sacci are more typical. The species is restricted to seams of the Blackstone Formation, and is likely to be of stratigraphical significance for correlation within the Ipswich Coal Measures.

Holotype (Plate 5, Figure 12).—Slide No. 98, Stage coordinates 12·8, 108·2; dimensions 104 x 78 microns. Coordinates of lower right-hand corner of cover glass 1·9, 121·1.

Figured specimen (Plate 6, Figure 1).—Slide No. 37, Stage coordinates 7·45, 113·0; diameter 83 microns. Coordinates of lower right-hand corner of coverglass 2·6, 116·8.

Locality of holotype.—Bore N.S. 92 (Ipswich Coalfield), 276 ft. 0½ in. to 279 ft. 9 in., Four Feet seam.

Spores and Pollen Grains (Incertae Sedis)

Genus CIRCULISPORITES, new genus

The generic name *Circulisporites* is proposed for dispersed fossil spores (or pollen grains?) of unknown affinity having the following characters:—

Outline circular or sub-circular (frequently folded). Alete, no definite tetrad markings or germinal mechanism observed. Exine ornamented by a series of concentric striae or low ridges. Striae continuous and relatively uniform in width.

Genotype.—The new species *Circulisporites parvus,* described below.

Remarks.—The only genus which bears any resemblance to *Circulisporites* is *Chomotriletes* Naumova from the Upper Devonian (Frasnian) of Russia. (Naumova 1953, p. 39; Potonié 1958, p. 22). In *Chomotriletes,* however, the concentric striae are incomplete, in contrast to the continuous striae of *Circulisporites* and in addition, the weak trilete laesurae, which may occur in the former genus, are completely lacking in the Ipswich specimens.

The species *Circulisporites parvus,* described below, is common in many of the Ipswich coal seams. A few rare specimens, appreciably larger in size, have been observed, which may suggest the presence of a second, larger species, but such specimens are too rare in the material examined to warrant detailed description.

Circulisporites parvus, new species

Plate 5, Figures 13, 14 and 15

Diagnosis.—Outline circular or sub-circular (frequently folded). Alete, no definite tetrad markings or germinal mechanism observed. Diameter (based on 87 measured specimens) 15 to 28 microns. Exine smooth on proximal (?) face, distal (?) face ornamented with a series of sub-circular to circular concentric striae, usually 2 to 6 in number, 1 to 3 microns in width (average 1·5 microns) and up to 3 microns apart. Ornament faintly to distinctly marked. Exine colourless to light yellow, less than 1 micron in thickness.

Remarks.—Owing to preferential flattening in the equatorial plane, it has been difficult to establish clearly that the ornament is confined to one face of the spore. However, observed occurrences of two sets of structures intersecting, which might be expected if both faces were ornamented, appear to be due rather to the adherence of two or more specimens of a tetrad, as in such cases the spores appear distinctly darker, as would be expected from the increased thickness of exine. The conclusion that only one face is ornamented is supported by examination of well preserved specimens with an oil-immersion objective at different planes of focus. This is exemplified by Plate 5, Figures 13 and 14, which are views of the holotype at different levels of focus, and suggest that only one set of structures is present.

Holotype (Plate 5, Figures 13 and 14).—Slide No. 212, Stage coordinates 19·5, 111·1; diameter 20 microns. Coordinates of lower right-hand corner of cover glass 4·1, 125·7.

Figured specimen (Plate 5, Figure 15).—Slide No. 16, Stage coordinates 11·5, 119·5; diameter 24 microns. Coordinates of lower right-hand corner of cover glass 3·0, 122·9.

Locality of holotype.—Bore N.S. 188 (Ipswich Coalfield), 1,340 ft. 0½ in. 1,345 ft. 8¾ in., Unnamed seam.

5. CONCLUSIONS

The spores and pollen grains described above are representative of the more abundant species in the Ipswich coal seams. The investigation has revealed the presence of a rich and varied microflora in these Triassic coals; the species of this microflora have been arranged, as far as possible, on the basis of affinities so as to enable their relationships to the species of the macro-flora from the Ipswich Coal Measures to be indicated. Noteworthy from this aspect are the pollen species *Alisporites australis* and *Alisporites sp.* 2, regarded as being closely related to the pollens of *Pteruchus africanus* and *P. dubius* respectively, which in turn are respectively regarded as the microsporangiate organs of the leaf-species *Dicroidium odontopteroides* and *D. feistmanteli.* Other species for which affinities with the macro-flora are suggested are *Calamospora tener,* probably derived from either *Equisetites* or *Neocalamites, Osmundacidites parvus,* which from its Osmundaceous affinities, is likely to be derived from *Cladophlebis,* and the various species of *Ginkgocycadophytus,* which have general affinities with the Ginkgoales and Cycadophyta and thus are probably related to the leaf genera *Ginkgoites* and *Pterophyllum.*

The investigation has resulted in the discovery of a number of new species, two of which have been proposed as the types of two new genera—*Circulisporites* and *Tenuisaccites. Circulisporites,* a small alete spore with an ornament of concentric striations, is common in many of the seams, while *Tenuisaccites,* a monosaccate pollen grain characterised by an alete, oval body and a thin, fragile saccus, has been found mainly in the coals of the Blackstone Formation. The new species have been described, illustrated by photomicrographs, and details of the location of the holotypes and their type localities are included. To provide a complete coverage of the microflora, species previously described from elsewhere have been re-described and re-figured on the basis of the Ipswich specimens.

Description of these species will provide a basis for a study of their distribution in the coal seams, which it is hoped to record in a later paper. It is also hoped, in this later work, to compare the microfloral sequence in the Ipswich Basin with that in other sedimentary deposits of Triassic age, both in Australia and overseas, and to discuss the evidence of the microflora on the age of the Ipswich Coal Measures.

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7. BIBLIOGRAPHY

BALME, B. E., 1957: Spores and pollen grains from the Mesozoic of Western Australia. *C.S.I.R.O. Phys. Chem. Surv. Nat. Coal Res., Tech. Comm.* 25 (December 1957).

————, and HENNELLY, J. P. F., 1956a: Monolete, monocolpate and alete sporomorphs from Australian Permian sediments. *Aust. J. Bot.*, **4**(1), 54-67.

————————, 1956b: Trilete sporomorphs from Australian Permian sediments. *Aust. J. Bot.*, **4**(3), 240-260.

CAMERON, W. E., 1923: Geological map of the Ipswich and Bundamba coalfields. *Geol. Surv. Qld. Publ.*, 271.

COOKSON, I. C. 1947: Plant microfossils from the lignites of Kerguelen Archipelago. *B.A.N.Z. Antarct. Res. Exped.*, **2**, pt. 8, 129-142.

COUPER, R. A., 1953: Upper Mesozoic and Cainozoic spores and pollen grains from New Zealand. *N.Z. Geol. Surv. Palaeont.* Bull., 22.

————, 1958: British Mesozoic microspores and pollen grains. A systematic and stratigraphic study. *Palaeontographica B*, **103**, 75-179.

DAUGHERTY, L. H., 1941: The Upper Triassic flora of Arizona. *Carnegie Inst. Washington, Publ.* 526, 1-108.

DE JERSEY, N. J., 1949: Principal microspore types in the Ipswich coals. *Univ. Qld. Dep. Geol. Pap.*, **3**(9).

————, 1959: Jurassic spores and pollen grains from the Rosewood coalfield. *Qld. Govt. Min. J.*, **60**, 346-366.

————, 1960: Jurassic spores and pollen grains from the Rosewood Coalfield. *Geol. Surv. Qld. Publ.*, 294.

DELCOURT, A., and SPRUMONT, G., 1955: Les spores et les grains de pollen du Wealdien du Hainaut. *Mem. Soc. Belge Geol., Nouv. Ser.*, (5).

DENMEAD, A. K., 1955: The West Moreton (Ipswich) coalfield. *Geol. Surv. Qld. Publ.*, 279.

HALLE, T. G., 1908: Zur Kenntnis der mesozoischen Equisetales Schwedens. *Kgl. Svenska Vetenskapsakad. Hand.*, 43.

HENNELLY, J. P. F., 1958: Spores and pollens from a Permian-Triassic transition, N.S.W. *Proc. Linn. Soc. N.S.W.*, **83**(3), 363-369.

KLAUS, W., 1960: Sporen der Karnischen Stufe der ostalpinen Trias. *Jb. Geol. B.A., Sonderb.* **5**, 107-183.

LESCHIK, G., 1955: Die Keuperflora von neuewelt bei Basel, II. Iso-und Mikrosporen. *Schweiz. Palaont. Abh.*, 72.

NAUMOVA, S. N., 1953: Spore-pollen complexes of the Upper Devonian of the Russian platform and their Stratigraphic significance. *Trans. Inst. Geol. Sci. Acad. Sci. U.S.S.R.*, **143** (*Geol. Ser.* **60**) (in Russian).

POTONIÉ, R., 1956: Synopsis der Gattungen der Sporae dispersae, I Teil : Sporites. *Beih Geol. Jb.* **23**, 1-103.

POTONIÉ, R., 1958: Synopsis der Gattungen der Sporae dispersae II Teil : Sporites (Nachträge), Saccites, Aletes, Praecolpates, Polyplicates, Monocolpates. *Beih. Geol. Jb.*, **31**, 1-114.

————, 1960. Synopsis de Gattungen der Sporae dispersae, III Teil : Nachträge Sporites, Fortsetzung Pollenites mit General register zu Teil I-III. *Beih. Geol. Jb.*, **39**, 1-189.

————, and KREMP, G. O. W., 1954: Die Gattungen der palaozoischen Sporae dispersae und ihre Stratigraphie. *Geol. Jb.*, **69**, 111-194.

ROUSE, G. E., 1959: Plant microfossils from Kootenay coal-measures strata of British Columbia. *Micropaleontology*, **5**(3), 303-324.

SUKH DEV, 1961: The fossil flora of the Jubalpur series — 3. Spores and pollen grains. *The Palaeobotanist*, **8**, 43-56.

THOMPSON, P. W. and PFLUG, H., 1953: Pollen und sporen des mitteleuropäischen Tertiärs. *Palaeontographica*, **9413**, 1-138.

TOWNROW, J. A., 1962: On some bisaccate pollen grains of Permian to Middle Jurassic age. *Grana Palynologica* (in press).

EXPLANATION OF PLATES

PLATE 1

(All photographs approximately 900 diameters)

Figure 1.—*Inapertisporites minutus* (de Jersey), n. comb.
Figure 2.—*Inapertisporites minutus* (de Jersey), n. comb.
Figure 3.—*Inapertisporites crassus* (de Jersey), n. comb.
Figure 4.—*Inapertisporites crassus* (de Jersey), n. comb.
Figure 5.—*Inapertisporites crassus* (de Jersey), n. comb.
Figure 6.—*Sphagnumsporites adnatus* de Jersey.
Figure 7.—*Sphagnumsporites tenuis* de Jersey.
Figure 8.—*Sphagnumsporites tenuis* de Jersey.
Figure 9.—*Calamospora tener* (Leschik), n. comb.
Figure 10.—*Calamospora tener* (Leschik), n. comb.
Figure 11.—*Osmundacidites parvus*, new species (Holotype).
Figure 12.—*Osmundacidites parvus*, new species (Three of tetrad).
Figure 13.—*Leiotriletes directus* Balme and Hennelly.
Figure 14.—*Concavisporites mortoni* (de Jersey), n. comb.
Figure 15.—*Concavisporites mortoni* (de Jersey), n. comb.
Figure 16.—*Annulispora microannulata*, new species.
Figure 17.—*Annulispora microannulata*, new species.
Figure 18.—*Annulispora folliculosa* (Rogalska).
Figure 19.—*Annulispora microannulata*, new species (Holotype).
Figure 20.—*Granulatisporites minor* de Jersey.

PLATE 2

Figure 1.—*Granulatisporites minor* de Jersey.
Figure 2.—*Verrucosisporites cameroni*, new species (Holotype).
Figure 3.—*Verrucosisporites cameroni*, new species.
Figure 4.—*Cingulatisporites pallidus*, new species.
Figure 5.—*Cingulatisporites pallidus*, new species (Holotype).
Figure 6.—*Punctatosporities walkomi*, new species (Holotype).
Figure 7.—*Punctatosporites walkomi*, new species.
Figure 8.—*Verrucososporites ipsviciensis*, new species (Holotype).
Figure 9.—*Verrucososporites ipsviciensis*, new species.
Figure 10.—*Verrucososporites ipsviciensis*, new species.
Figure 11.—*Verrucososporites* sp.
Figure 12.—*Verrucososporites* sp.
Figure 13.—*Alisporites* sp. 2.
Figure 14.—*Alisporites australis*, new species.

PLATE 3

Figure 1.—*Alisporites sp.* 1.
Figure 2.—*Alisporites sp.*
Figure 3.—*Alisporites australis*, new species (Holotype).
Figure 4.—*Alisporites australis*, new species.
Figure 5.—*Alisporites sp.*
Figure 6.—Indeterminate Monosaccate pollen.

PLATE 4

Figure 1.—*Alisporites parvus*, new species (Holotype).
Figure 2.—*Alisporites parvus*, new species.
Figure 3.—*Alisporites parvus*, new species.
Figure 4.—*Alisporites parvus*, new species.
Figure 5.—*Platysaccus queenslandi*, new species (Holotype).
Figure 6.—*Platysaccus queenslandi*, new species.
Figure 7.—*Vitreisporites contectus* (de Jersey), n. comb.
Figure 8.—*Vitreisporites subtilis* (de Jersey), n. comb.
Figure 9.—*Vitreisporites subtilis* (de Jersey), n. comb.
Figure 10.—*Chordasporites australiensis*, new species (Holotype).
Figure 11.—*Chordasporites australiensis*, new species.

PLATE 5

Figure 1.—*Ginkgocycadophytus nitidus* (Balme), n. comb.
Figure 2.—*Ginkgocycadophytus nitidus* (Balme), n. comb.
Figure 3.—*Ginkgocycadophytus nitidus* (Balme), n. comb.
Figure 4.—*Ginkgocycadophytus crassimarginis* (de Jersey), n. comb.
Figure 5.—*Ginkgocycadophytus granulatus*, new species (Holotype).
Figure 6.—*Ginkgocycadophytus granulatus*, new species.
Figure 7.—*Ginkgocycadophytus granulatus*, new species.
Figure 8.—*Ginkgocycadophytus adjectus*, new species (Holotype).
Figure 9.—*Ginkgocycadophytus adjectus*, new species.
Figure 10.—*Ginkgocycadophytus adjectus*, new species.
Figure 11.—*Araucariacites sp.*
Figure 12.—*Tenuisaccites fragilis*, new species (Holotype).
Figure 13.—*Circulisporites parvus*, new species (Holotype).
Figure 14.—*Circulisporites parvus*, new species (Holotype).
Figure 15.—*Circulisporites parvus*, new species.

PLATE 6

Figure 1.—*Tenuisaccites fragilis*, new species.
Figure 2.—*Callialasporites denmeadi*, new species (Holotype).
Figure 3.—*Callialasporites denmeadi*, new species.
Figure 4.—*Pilasporites fuscus*, new species (Holotype).
Figure 5.—*Pilasporites fuscus*, new species.
Figure 6.—*Laricoidites reidi* (de Jersey), n. comb.

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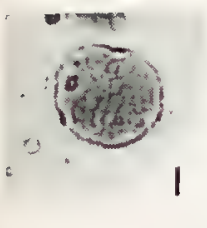
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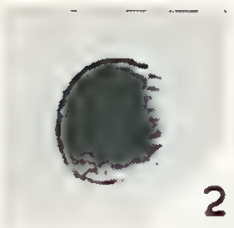
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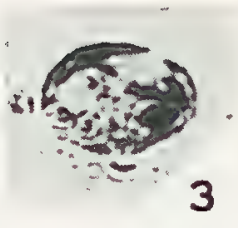
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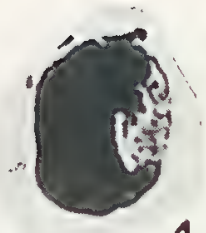
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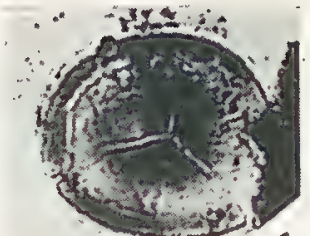
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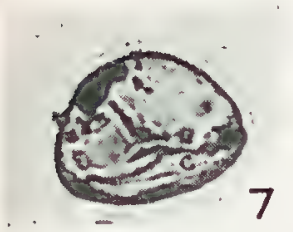
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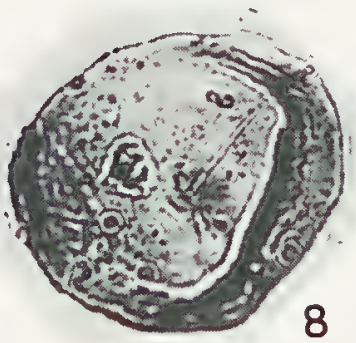
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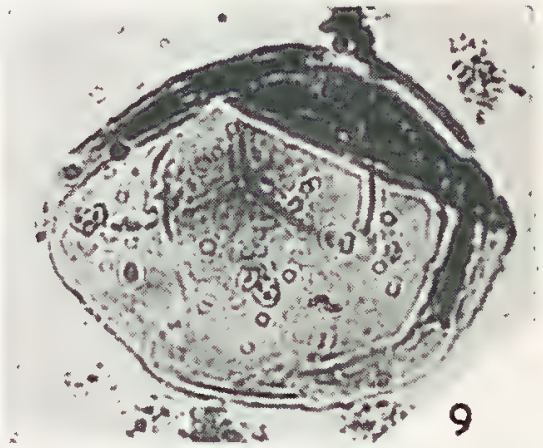
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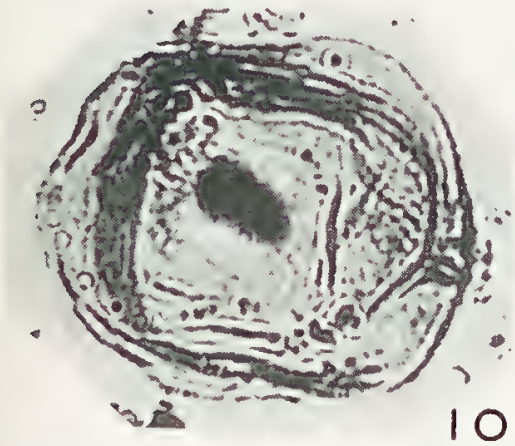
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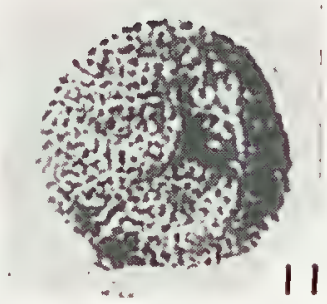
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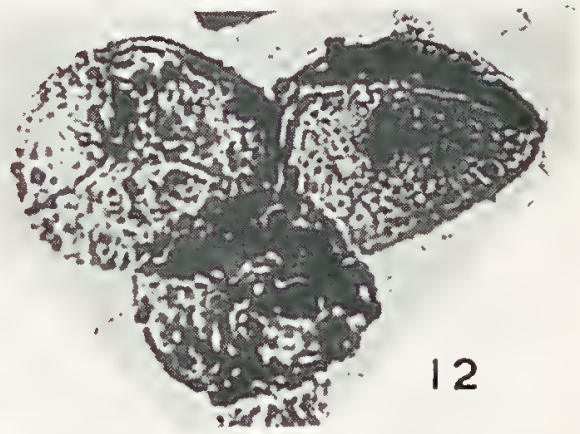
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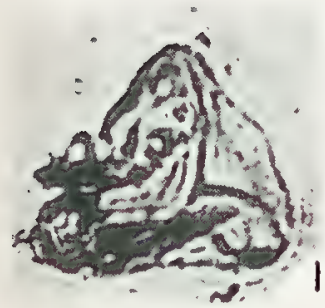
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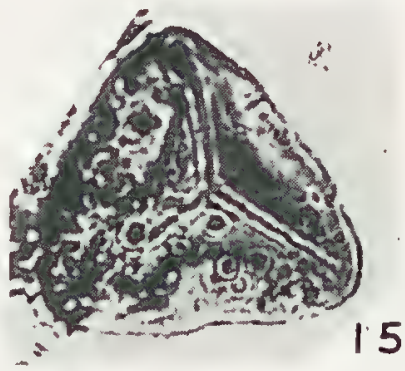
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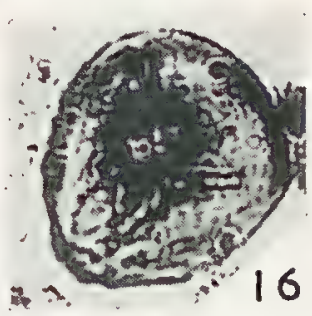
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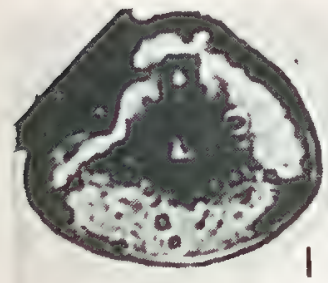
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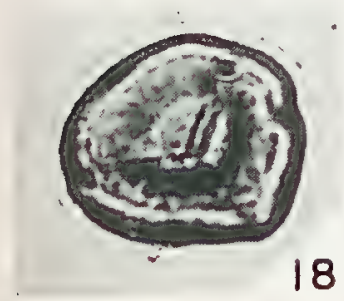
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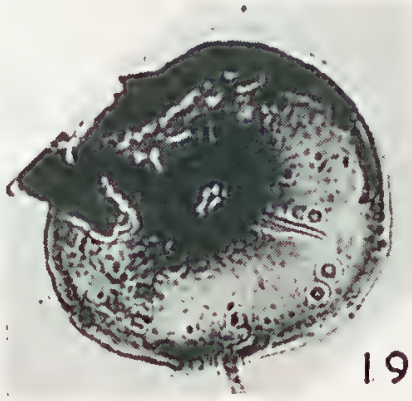
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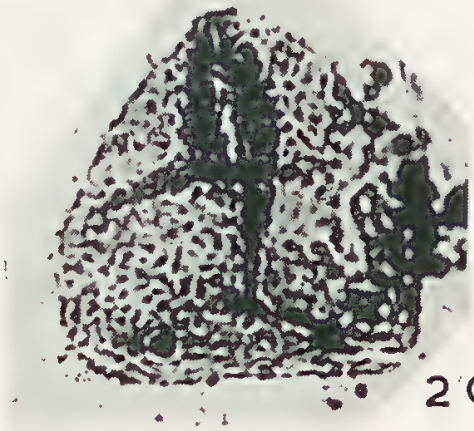
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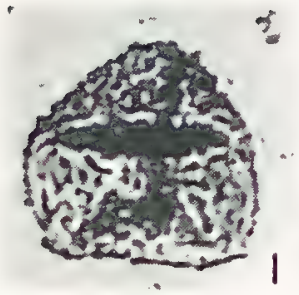

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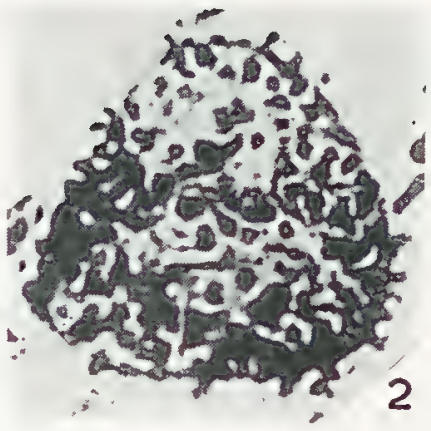

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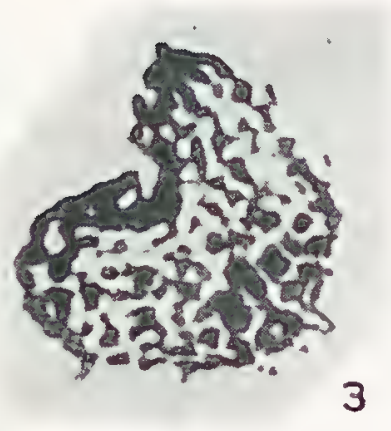

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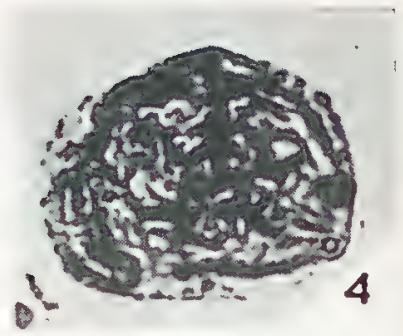

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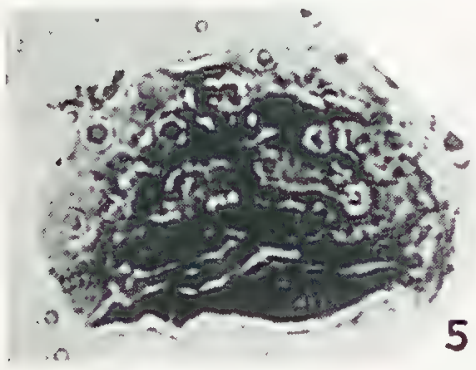

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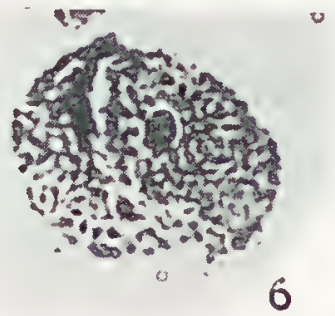

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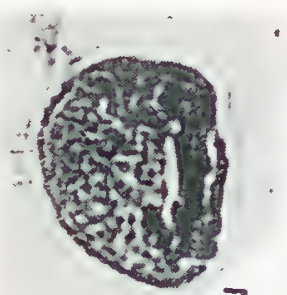

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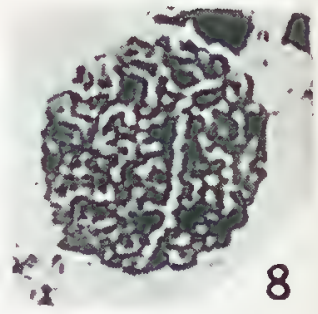

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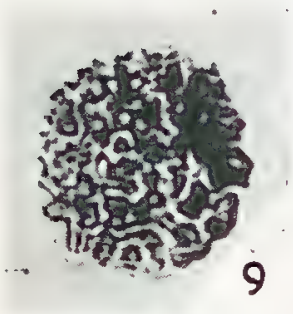

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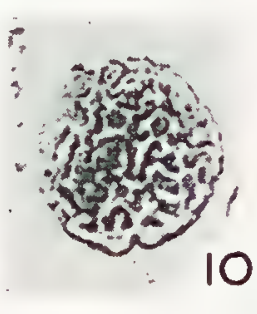

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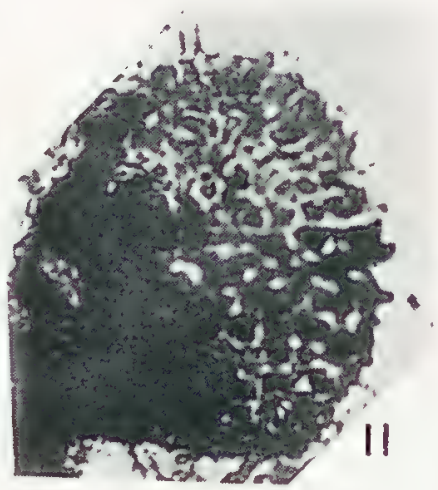

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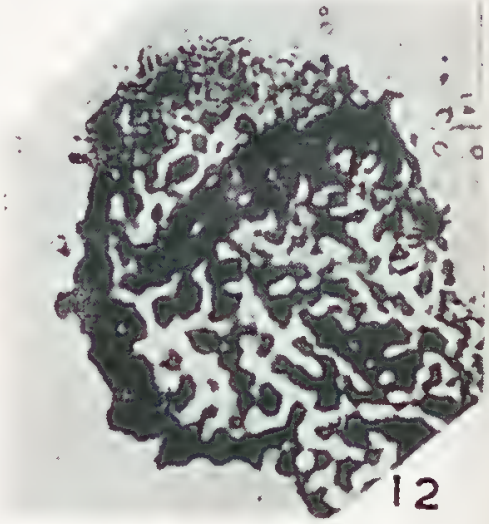

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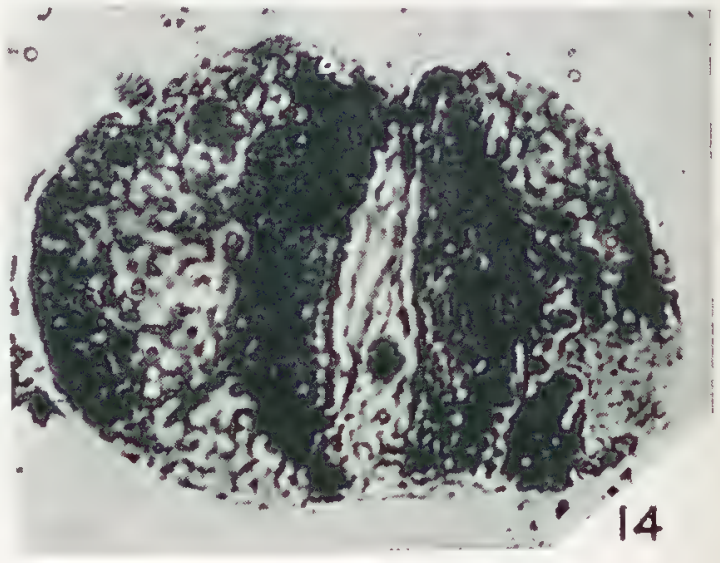

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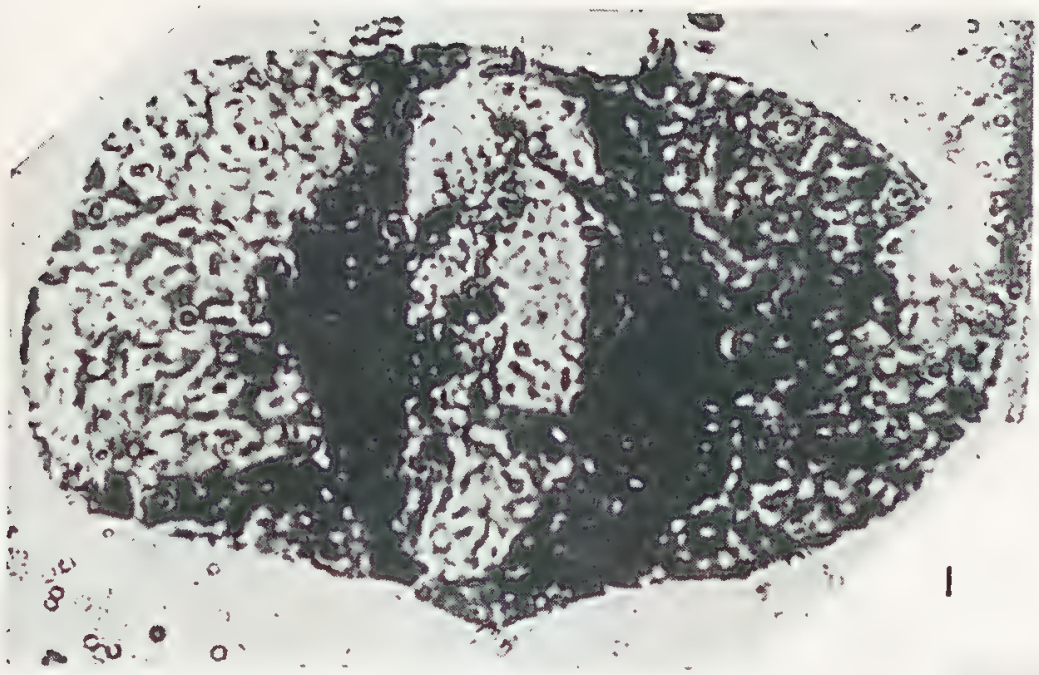

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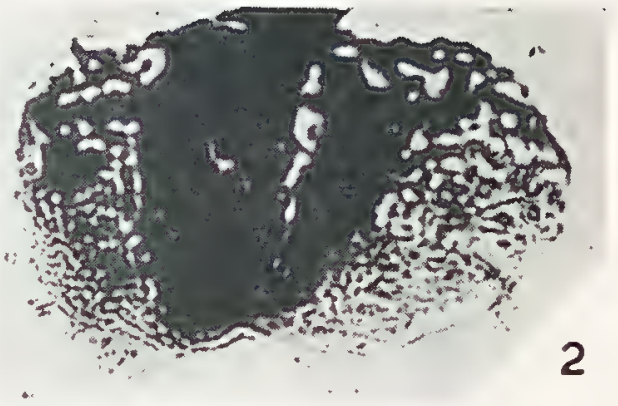

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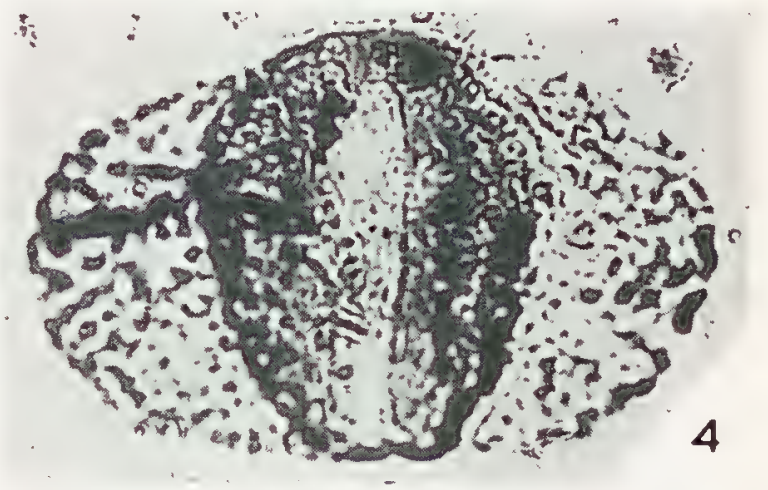

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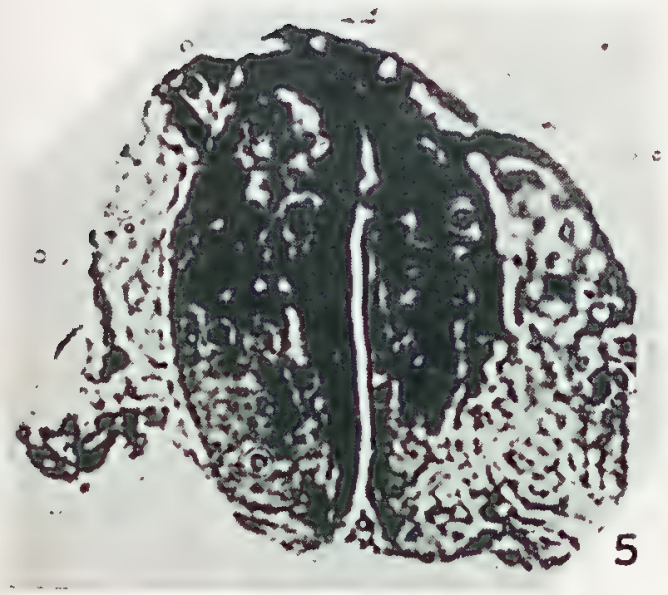

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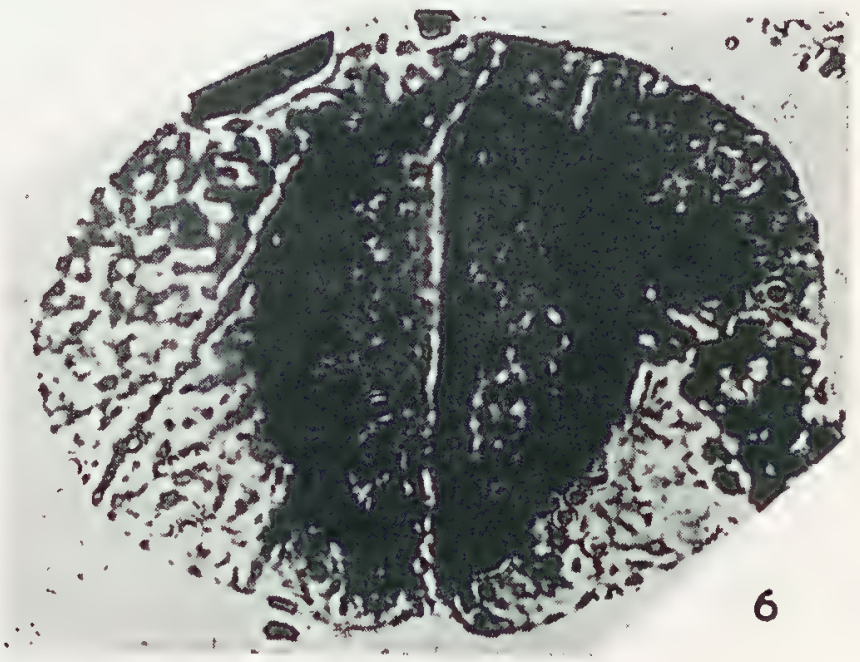

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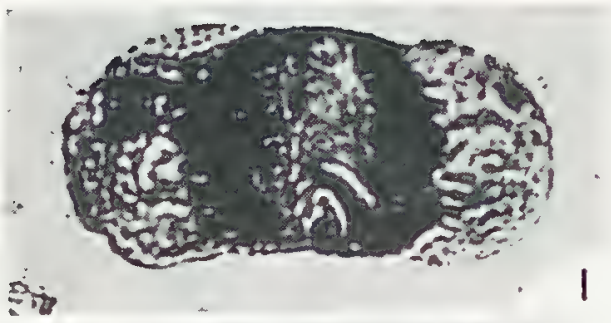
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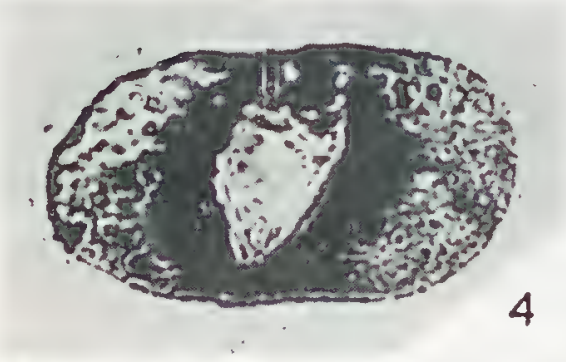
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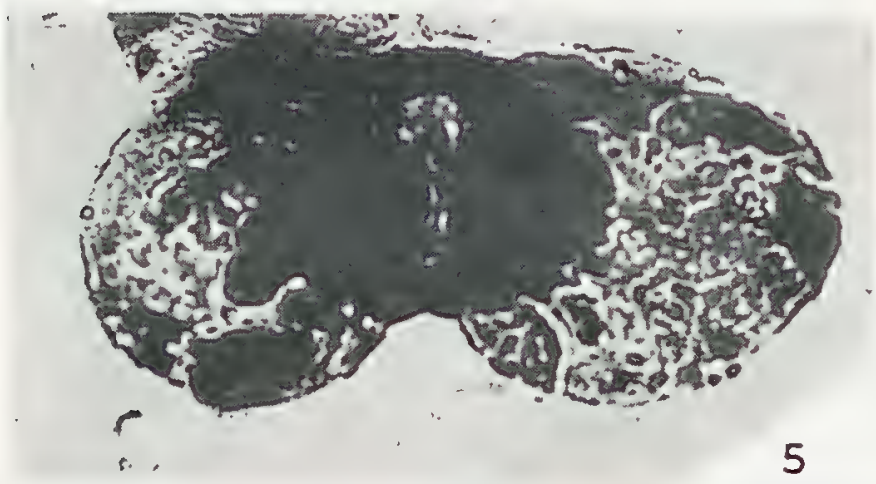
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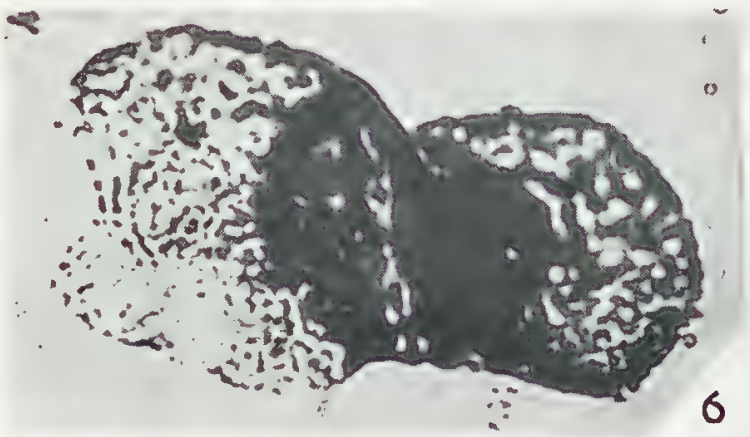
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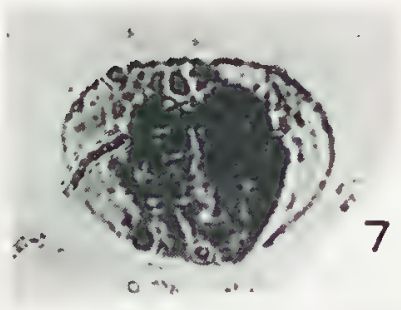
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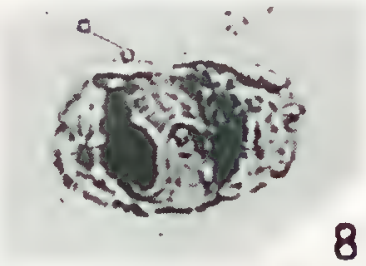
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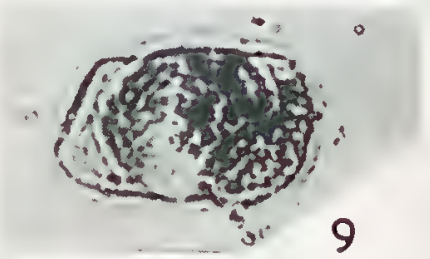
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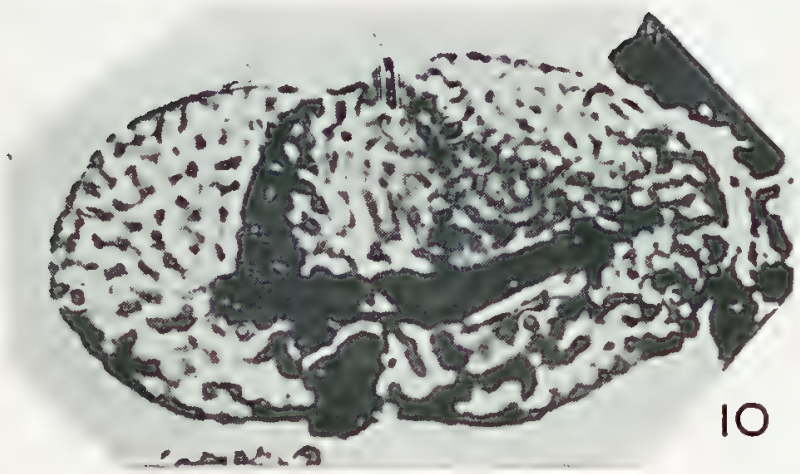
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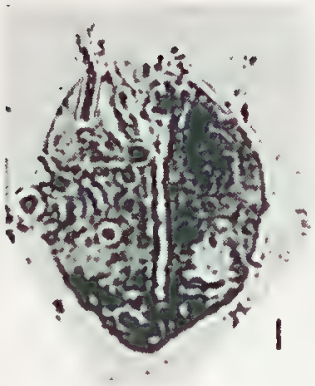
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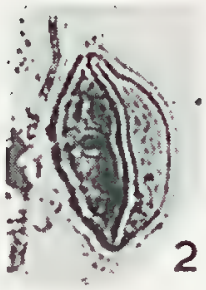
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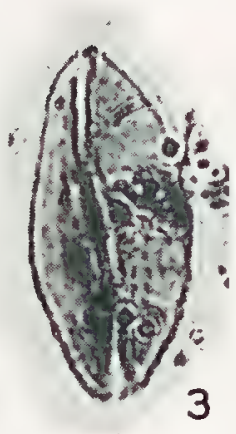
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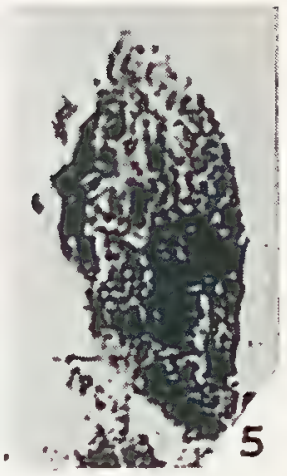
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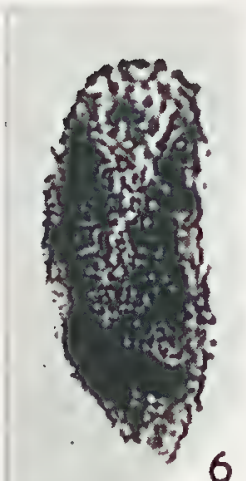
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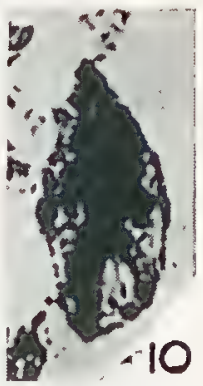
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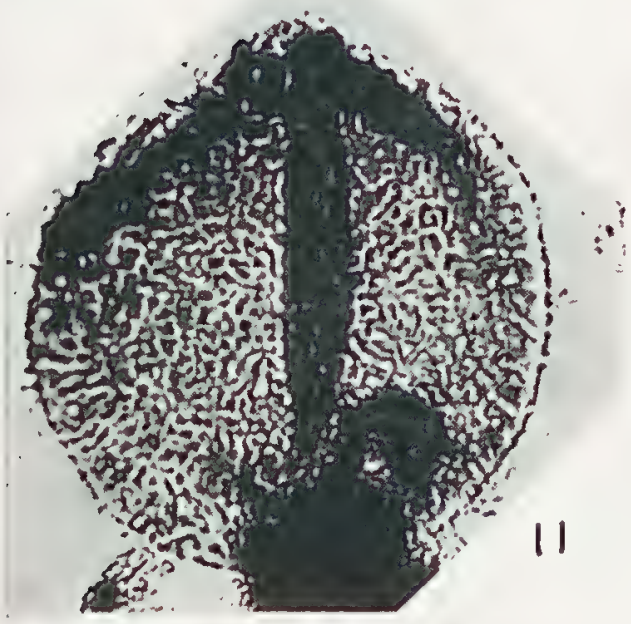
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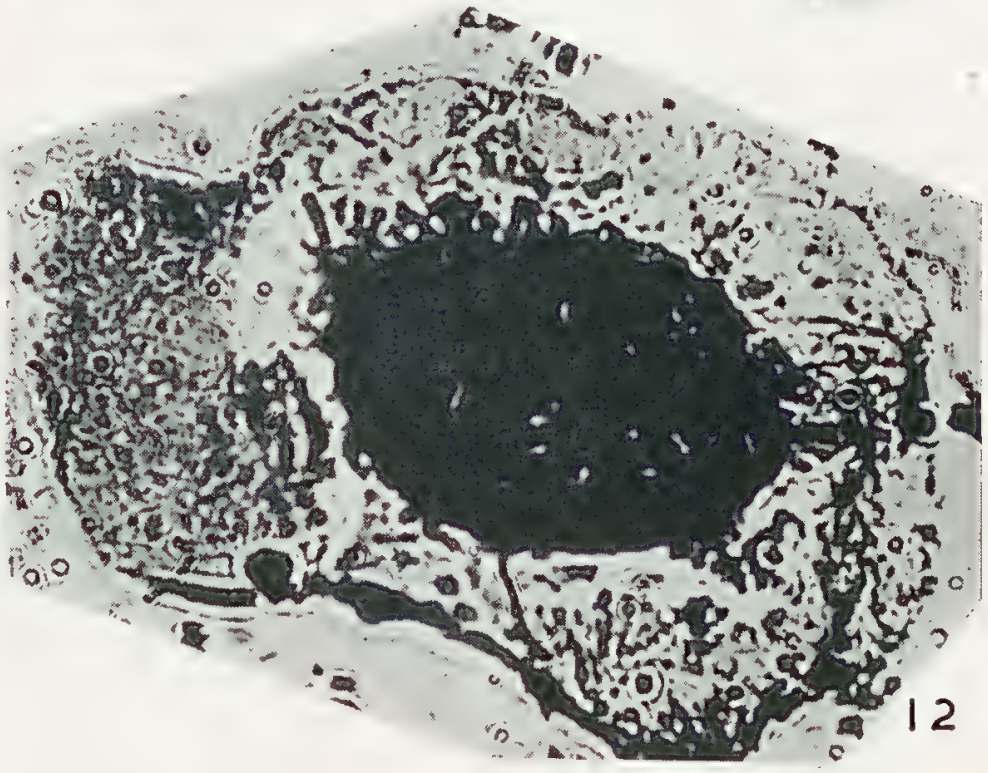
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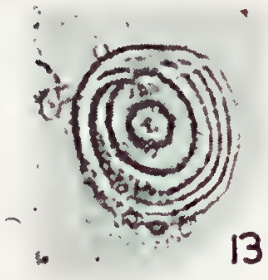
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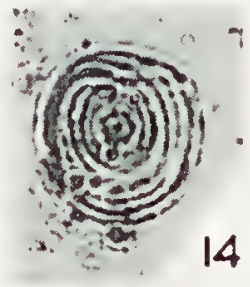
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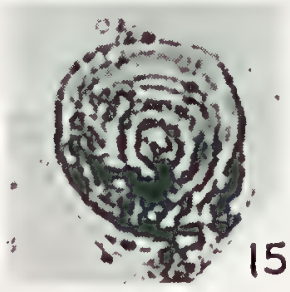
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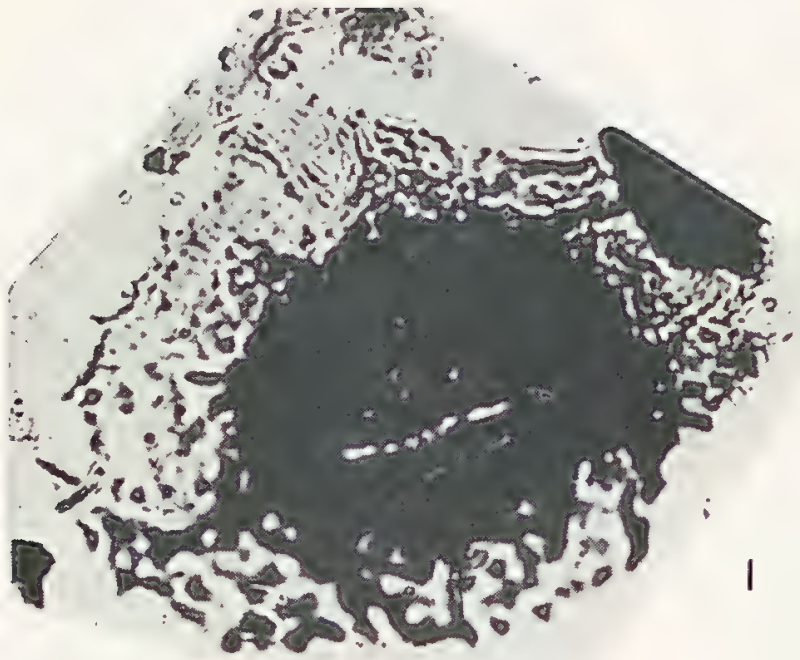
PLATE 5



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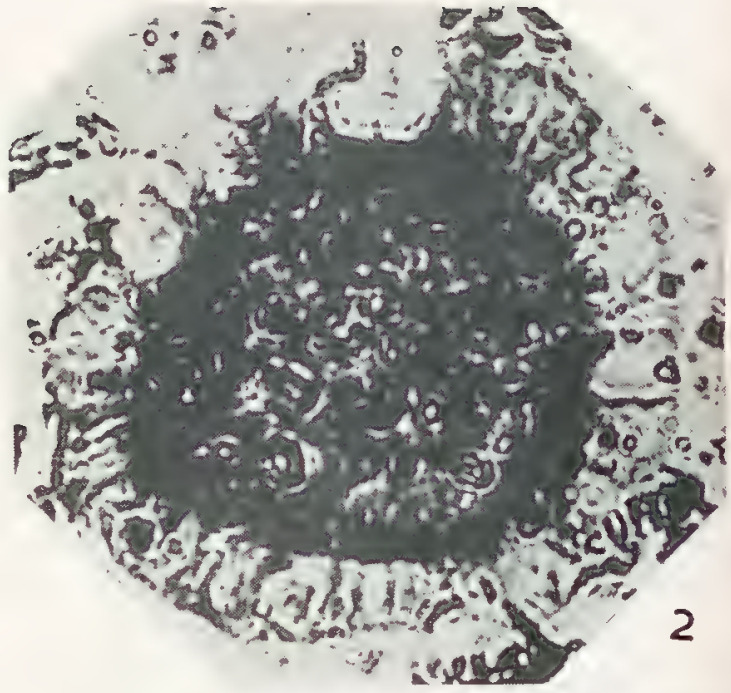

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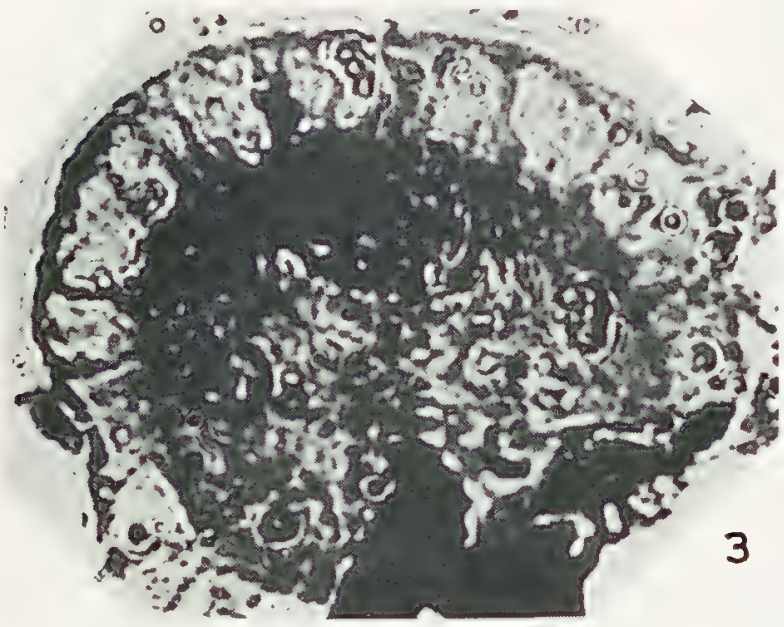

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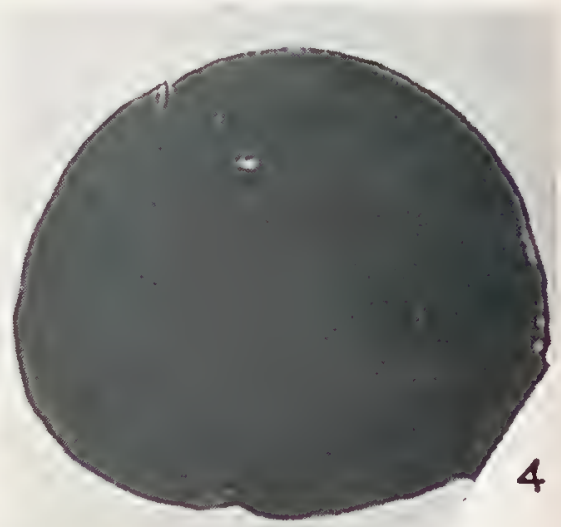

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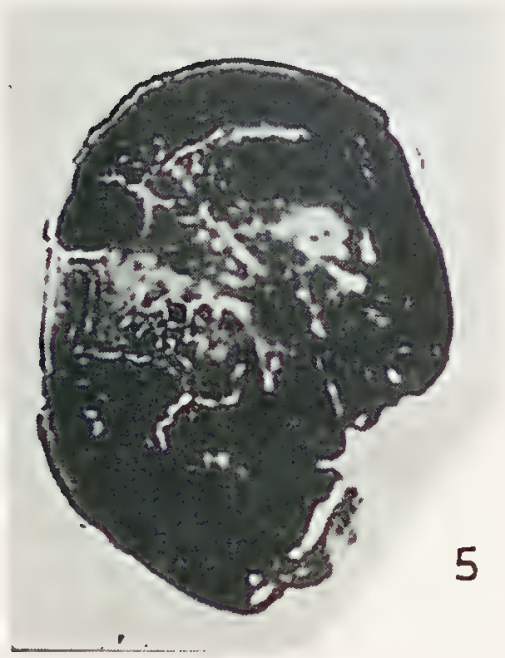

5

6

PLATE 6

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 308

MARY VALLEY MANGANESE DEPOSITS

By J. H. BROOKS, B.Sc.

BRISBANE
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MARY VALLEY MANGANESE DEPOSITS

By J. H. Brooks, B.Sc.

Abstract

In the 1957-60 period over 13,000 tons of manganese ore were produced from 17 deposits in the upper Mary Valley. Most of the production came from the *Amamoor* (7,850 tons), the *Imbil West* (2,120 tons) and the *Upper Kandanga* (2,274 tons). Practically all the ore was of metallurgical grade and production of battery grade ore has amounted to only a few hundred tons.

The deposits are confined very largely to a succession of shale, quartzite, andesite and jasper which is equivalent to part of the Neranleigh-Fernvale Group of lower Palaeozoic age. Metamorphism is slight, but structural deformation is locally intense. Productive manganese deposits occur in a well-defined, north-north-westerly trending belt, 50 miles long and 7 miles wide, from the Nanango branch railway line in the north to the Conondale area in the south. The supergene concentration of manganese oxides has been controlled principally by faults and joints although fold structures exercise a control in some deposits. X-ray and chemical analyses indicate that the most important manganese minerals are cryptomelane, braunite and pyrolusite. Hausmannite, γ–MnO_2, rhodonite and piedmontite have also been identified. Silica is the only deleterious impurity present in the ores in significant amounts.

Proved and indicated reserves of +40 per cent Mn ore are estimated to be less than 3,000 tons but little attempt has been made to prove reserves ahead of mining. Probably 25,000 tons of +30 per cent Mn ore remain in the known deposits. The prospects for the discovery of new deposits are considered to be reasonably good, especially in the larger forest reserves. Future market conditions for metallurgical ore will be more difficult than in the past because of the change of the Australian buying point from Newcastle to Bell Bay, Tasmania.

Introduction

The most productive period of manganese mining in the Mary Valley took place between 1957 and 1960. Practically all the known deposits were then held under mining titles, and exploration and development were carried out on all but a few of them. This made the time opportune for a comprehensive geological examination which was made between April and August 1960. Brief inspections of the main deposits had previously been made in 1956 and 1959. Field work occupied 22 days and assistance was given by Messrs. N. A. H. Simmonds and L. G. Cuttler, geologists, for periods of 6 days and 8 days respectively.

The manganese deposits are in the upper Mary Valley. Gympie, the largest town in the area (population 10,000) is 120 miles by road north of Brisbane. The upper Mary Valley is served by a branch railway line from Gympie, the main centres for the consignment of manganese being Amamoor, Kandanga and Imbil. The nearest ports are Maryborough and Brisbane which are 61 and 106 miles by rail respectively from Gympie. Gladstone, the nearest port with bulk-loading facilities, is 222 miles from Gympie.

The Mary River pursues a meandrine, northerly course and receives its main tributaries, Little Yabba, Yabba, Kandanga, Amamoor, Eel, Glastonbury and Widgee Creeks from the west. With the exception of the *Mt. Walli* deposits, the manganese deposits are on the western side of the Mary River. The upper Mary Valley is an area of moderately high relief, ranging from 200 feet above sea level along the Mary River flats to 2,074 feet at Mt. Allan. It lies between the 40- and 50-inch isohyets and has a pronounced late summer rainy season.

Nearly half the area is occupied by forest reserves and the remainder is subdivided mainly into freehold properties which have been cleared for cultivation and dairying. Some of the forest reserve areas have been cleared for pine tree plantations, but for the most part the reserves are covered by natural stands of timber which are being systematically logged.

Acknowledgements

The assistance of leaseholders and property owners in the area, particularly Mr. T. H. Sanders, Mr. H. B. Trigger and Mr. B. Soanes, was greatly appreciated. I am indebted to Mr. K. H. Deasy of the Government Chemical Laboratory, Brisbane, for chemical analyses, and to Mr. J. Tuffley of the University of Queensland, Department of Mining Engineering, for X-ray analyses. Miss B. R. Houston described several rock slides. Assistance was also received from the staff of the Mining Warden's office at Gympie.

History and Production

Manganese mining in the Mary Valley has been restricted very largely to four short periods with long intervening periods of inactivity. The productive periods have been 1918-1922 (3,000 tons), 1937-1938 (3,000 tons), 1949-1950 (1,500 tons), and 1957-60 (13,000 tons). The earliest production was in the 1908-1910 period when 187 tons of ore were sent to Mt. Morgan from the *Mt. Nansen* (*Queen Mary*) mine,

for use in the gold extraction process. One of the pioneers of the industry was Mr. Zachariah Skyring who is recorded as having mined 81 tons of ore from *Mt. Mooloo* in 1915 and carted it to the railhead by bullock wagon. Apart from the ore sent to Germany from the *Amamoor* and *Mt. Walli* deposits by Queensland Ores Development Pty. Ltd. in the 1937-1938 period, all the metallurgical ore has been sent to Broken Hill Proprietary Co. Ltd. at Newcastle. Most of the ore has gone by rail although road transport was also used in the 1957-1959 period until concession rate of £6 10s. per ton was obtained for rail freight to Newcastle. About 300 tons of battery grade ore have been sold to Metals and Ores Co. at Sydney, while in 1954 a few hundred tons of ore were sent to Territory Enterprises Pty. Ltd., Rum Jungle, from the *Mt. Allan* deposit for use in the uranium extraction process.

The price for metallurgical grade ore remained low till after World War II. In 1946 the Australian price for ore assaying 48 per cent. Mn and having less than 8 per cent. SiO_2 and 8·5 per cent. Fe was only £4 15s. per ton, which was little higher than the price for ore of this grade in 1920. By 1956 the price had risen to £16 6s. for ore assaying 48 per cent. Mn. Even allowing for the rapid rise in costs in the 1946-1956 period, this represented a considerable improvement in market conditions. Prior to World War II, ore assaying less than 50 per cent. Mn was difficult to market but in 1946 ore assaying 45 per cent. Mn was acceptable and by 1956 the minimum acceptable Mn content had been reduced to 40 per cent. The improved market and the less stringent grade requirements have resulted from the comparative scarcity of accessible manganese deposits in Australia and the rapid post-war increase in steel production. The market for battery grade ore has shown a corresponding improvement due to the scarcity of this class of ore. The price for ore containing 75 per cent MnO_2 has risen from £8 5s. per ton in 1946 to £35 in 1960.

The efficiency of manganese mining has been greatly increased by the use of mechanical earth-moving equipment. Bulldozing was used in a small way by Messrs. Young and Campbell at their *Yabba Creek* mine in 1949 but Mr. T. H. Sanders fully exploited this method of operation in recent years. He used his earth-moving equipment for dam-building, road-making and scrub-clearing in addition to manganese mining and this considerably improved the economy of operation. In 1938 Queensland Ores Development Pty. Ltd. set up a washing plant on Amamoor Creek to remove clay and shale adhering to the ore from the *Amamoor* mine. Apart from this no attempt has been made to beneficiate the ore by mechanical means.

In 1957 the main deposits were held under lease by Mr. W. J. O'Neill (Amamoor, Upper Kandanga, Mt. Walli and Yabba Creek), Mr. G. A. Campbell (Imbil West) and Mr. J. G. Craig (Old Bollier and Mt. Allan, sub-lease). Mr. T. H. Sanders arranged to mine these deposits on a tribute basis, and, in addition, he took up and mined other deposits on his own behalf or in partnership. A total of 56 leases and claims for manganese mining were held in 1959-60 and there were 12 deposits unclaimed or on which leases had lapsed. Of a total of over 60 known deposits, 25 have been productive but only 8 have produced more than 500 tons of ore. These are: *Amamoor* (11,912 tons), *Imbil West* (2,598 tons), *Upper Kandanga* (2,305 tons plus 1,000 tons stockpiled), *Yabba Creek* (953 tons), *Mt. Allan* (949 tons), *Mt. Walli* (720 tons), *Old Bollier* (573 tons) and *Skyring Creek* (515 tons). Of a total production to 1960 of 21,000 tons more than half has come from the *Amamoor*. The small production of battery grade ore has come mainly from *Mt. Allan* (182 tons) and *New Bollier* (72 tons).

In 1960 Broken Hill Proprietary Co. Ltd. suspended buying ore at Newcastle pending the construction of a new ferro-alloy plant at Bell Bay, Tasmania. The buying of metallurgical grade ore is not expected to recommence till 1962. Exports of manganese ore are restricted to an amount representing one-third of the ore reserves proved since June 1956. Although an export licence was granted to Mr. T. H. Sanders in 1959, no ore has yet been sold overseas. Future production of metallurgical grade ore from the Mary Valley will be dependent on the ability of producers to cope with the increased transport costs involved in marketing the ore in Tasmania or overseas. In addition, it will be necessary to have the financial resources and ore reserves to be able to continue mining until a parcel of ore of sufficient size for shipment is stockpiled.

TABLE 1. PRODUCTION OF MANGANESE ORE

Deposit	Metallurgical Ore			Year	Battery Ore		Total Production	Destination of Ore
	Tons	Mn%	SiO_2%		Tons	MnO_2%		
Amamoor, M.L. 120	1,600*	53	3	1920–26	..	..		B.H.P., Newcastle and Overseas?
	2,249	53	..	1937–38	..	..		Germany
	213	50	5	1950–54	..	..		B.H.P., Newcastle
	7,844	47	12	1958–60	..	..		B.H.P., Newcastle
					3	79·3		Metals and Ores, Sydney
					3	69·5		Metals and Ores, Sydney
							11,912	
Borgs	20	49	8	1949	..	..	20	B.H.P., Newcastle

* Approximate figures.

TABLE 1. PRODUCTION OF MANGANESE ORE—*continued*

Deposit	Metallurgical Ore			Year	Battery Ore		Total Production	Destination of Ore
	Tons	Mn%	SiO_2%		Tons	MnO_2%		
Branch Gully, M.L. 241 ..	21	45	21	1959–60	..	..		B.H.P., Newcastle
					3	67·2		Metals and Ores, Sydney
							24	
Cedar Gully, M.L. 4733 ..	80	35	36	1959				B.H.P., Newcastle
					10	79·5		Metals and Ores, Sydney
							90	
Dagun, M.L. 234	100*	48	5	1921	..	..		B.H.P., Newcastle
	Small	tonnage		1949	..	..		B.H.P., Newcastle
							100	
Devils Mount, M.L. 263, 264	10	..	..	1960	..	..		B.H.P., Newcastle
							10	
Donaldsons, M.L. 242 ..	25	46	15	1960	..	..		B.H.P., Newcastle
							25	
Dwyers, M.L. 216	20	48	12	1959	..	..		B.H.P., Newcastle
							20	
Eel Creek, M.L. 243	161	50	6	1949	..	..		B.H.P., Newcastle
				1951	14	73		Metals and Ores, Sydney
				1960	5	72		Metals and Ores, Sydney
	38	46	15	1960				B.H.P., Newcastle
							218	
Imbil West, M.L. 159	15	..	..	1918	..	..		B.H.P., Newcastle?
	2,583	41	25	1954–60	..	..		B.H.P., Newcastle
							2,598	
Imbil No. 2, M.L. 244 ..	18	44	22	1959	..	..		B.H.P., Newcastle
							18	
Kilkivan, M.L. 258	54	..	..	1918–19	..	..		Sydney
							54	
Mount Allan, M.L. 104, 109 ..	..	..	..	1943–44	56	75		Metals and Ores, Sydney
				1950–51	60	80		Metals and Ores, Sydney
				1953	15	75		Metals and Ores, Sydney
				1954	500?*	75+		Territory Enterprises, Rum Jungle
				1959	51	76		Metals and Ores, Sydney
	267	47	9	1959	..	..		B.H.P., Newcastle
							949	
Mount Mooloo, M.L. 261 ..	81	50	2	1915	..	..		Mount Morgan
					?	?	81	
Mount Walli, M.L. 124 ..	700*	48	9	1937–38	..	..		Germany
	20	40	20	1959	..	..		B.H.P., Newcastle
							720	
New Bollier, M.L. 217, 218 ..	..	..	..	1950	60	80		Metals and Ores, Sydney
	5			1959–60	12	75		B.H.P., Newcastle
							77	
Old Bollier, M.L. 213	157	..	..	1918	..	..		B.H.P., Newcastle
	416	42	23	1958–59	..	..		B.H.P., Newcastle
							573	
Queen Mary, M.L. 229 ..	187	..	..	1908–10	..	..		Mount Morgan
							187	
Rendells, M.L. 257	..	..	..	1949	6	80		Metals and Ores, Sydney
							6	
Skyring Creek, M.L. 227 ..	510	43	17	1960	..	..		B.H.P., Newcastle
					5	75		Metals and Ores, Sydney
							515	
Skyring Creek, M.L. 228 ..	10	45	19	1960	..	..		B.H.P., Newcastle
							10	
Upper Kandanga, M.L. 131 ..	911	44	21	1918–19	..	..		B.H.P., Newcastle
	1,394	46	22	1958–60	..	..		B.H.P., Newcastle
	1,000	..	..	1960	..	..		Stockpiled
							2,305	

* Approximate figures.

TABLE 1. PRODUCTION OF MANGANESE ORE—*continued*

Deposit	Metallurgical Ore			Year	Battery Ore		Total Production	Destination of Ore
	Tons	Mn%	SiO_2%		Tons	MnO_2%		
Yabba Creek, M.L. 158 ..	953	52	12	1949–50	..	..	953	B.H.P., Newcastle
Yabba Creek, Ford	5	50	10	1949	..	..	5	B.H.P., Newcastle
Zachariah Creek, M.L. 162 ..	Small	tonnage	..	1920–22	..	..		B.H.P., Newcastle
	16	40	..	1959	..	..	16	B.H.P., Newcastle

Total Production—Metallurgical Ore	20,516
Battery Ore	803
Combined Total Production	21,319
Ore Stockpiled	1,000

NOTES ON THE GENERAL GEOLOGY

The manganese deposits occur in a north-north-westerly trending belt of low-grade metamorphic rocks which are correlated with the Neranleigh-Fernvale Group in the Brisbane Metamorphics. The only detailed general description of the geology of the Mary Valley is contained in an honours thesis submitted to the Geology Department, University of Queensland, in 1951, by Mr. W. G. Burns, entitled "The nature and origin of the manganese ores of the Mary Valley, Queensland". The "Geology" section of this thesis has been published in the "Queensland Government Mining Journal" (Burns, 1961). No detailed geological mapping was carried out during the recent survey except in the immediate vicinity of manganese deposits but some brief observations on the general geology are set out below.

The strata of the eastern and central parts of the manganese belt are only slightly metamorphosed and consist of shale, quartzite, andesite, jasper, chert and indurated mudstone. Metamorphism increases from east to west but in the western part of the manganese belt the grade of metmorphism is still quite low. Slate, phyllite and chlorite schist occur in this area.

The only rock types which crop out strongly are jasper and quartzite but exposures in road cuttings and mine workings indicate that argillaceous sedimentary rocks predominate in the succession. In addition, andesite and andesitic tuff appear to be more widespread than previously recognised. A fairly extensive development of andesitic rocks is exposed in the Skyring Creek-Zachariah Creek area west of Amamoor. The country rock of the manganese deposits in this area (M.L. 120, 227, 228 and 162) is a greenish-brown to green, weathered rock which is amygdaloidal in part. It has not been found fresh enough for positive identification but is almost certainly an andesitic volcanic rock. Another important development of andesitic volcanics is indicated by exposures in road cuttings between Kenilworth Forestry Station and Mt. Allan where they are almost as abundant as the interbedded slate and phyllite. Other exposures of weathered andesite were observed at *Thomas, Mt. Walli No.* 2 and *Milne's* prospects, and in the Slack's Creek area, Glastonbury Forest Reserve 124. Jasperoid rocks are very commonly associated with manganese deposits but in most places these rocks are considered to represent silicified red shales rather than sedimentary jaspers. Radiolarian jaspers have been found (Burns, 1961) but are very restricted in occurrence.

Basic to sub-basic minor intrusions were observed near several manganese prospects (see *Smith's, Plate's, Zachariah Creek, Arnold's,* and *Branch Gully* No. 2 prospects). They rarely crop out and are usually represented at the surface by floaters. Granitic intrusions are comparatively rare, except in the Devil's Mountain-Glastonbury area in the far north, and the Conondale area in the far south, where large intrusions of granite crop out.

Mr. L. C. Ball (1904) described the manganese deposits and the associated jasper-slate succession in the Kholo area (north of Ipswich), and noted the widespread association in eastern Queensland of manganese deposits and jasper in the "older" rocks. The correlation of the rocks of the Mary Valley manganese belt with the (?) Silurian Neranleigh-Fernvale Group has never been questioned although the correlation is based primarily on lithology (Denmead, 1928, p. 93). Apart from radiolaria the Neranleigh-Fernvale Group equivalents are unfossiliferous.

In an unpublished report to the Chief Government Geologist of 27-11-1930, Mr. C. C. Morton recorded the occurrence of fossil shells in the southern half of portion 40, parish of Cambroon, 2½ miles south-south-west of Kenilworth. The fossils were found in a thin bed of impure limestone and were located during an inspection of gold workings. The main rock type in the area is a rather massive conglomeratic shale. The pebbles in the shale vary greatly in abundance and are usually siliceous in composition. Some andesitic tuff and agglomerate also occur in the area. On the fossil evidence he assigned the strata to the Gympie Group. A recent search for the fossil locality was unsuccessful.

FIG.1

LOCALITY MAP

MARY VALLEY MANGANESE DEPOSITS

To accompany a report by J.H.Brooks B.Sc., Geologist. 10.3.1961

Scale of Miles

4 2 0 4 8

Geological boundaries from Moreton District Map (1955), Burns (1951 unpub.), Ridley (1960) with additions by J.H.Brooks.

LEGEND

- Main Road
- Other Roads
- Railways
- Boundary of a Forest Reserve
- ? North Arm Volcanics
- Myrtle Creek Formation
- Gympie Group
- Neranleigh Fernvale Group equivs.
- S Serpentine
- + Acid-intermediate Intrusions
- Deposit, production > 500 tons with some prospects of future production.
- Deposit, production > 500 tons with poor prospects of future production.
- Deposit, production < 500 tons with some prospects of future production.
- Deposit, production < 500 tons with poor prospects of future production.
- Prospect which warrants exploration.
- Prospect of little or no significance.

b indicates that some battery grade ore was produced from the deposit.

INDEX OF LEASES

104 Mt.Allan (Also 109, 150)
120 Amamoor (Previously 88)
124 Mt.Walli (Also 215, 226)
130 Yabba Creek Ford (ftd.)
131 Upper Kandanga (Also 214, 225)
136 Borg's (ftd)
158 Yabba Creek
159 Imbil West
162 Zachariah Ck.
212 Milne's (Mary Ck.)
213 Old Bollier
216 Dwyer's (Yabba Ck.)
217, 218 New Bollier
219 Muir's
220 Quarry
221 Laver's (Glastonbury)
222 Reeves
223, 224 Lowe's
227 Skyring Ck. No.1
228 " " No.2
229 Queen Mary
230 Craig's (Yabba Ck.)
231 Langshaw
232 Smith's (Glastonbury)
233 Soanes' (Yabba Ck.)
234 Dagun (Also 247)
235 Branch Gully No.2
236 Plate's (Mt. Mooloo)
238 Hidden
239 Kandanga
241 Branch Gully
242 Donaldson's (Mary Ck.)
243 Eel Creek
244 Imbil No.2
246 Passlow's (Mt. Allan)
248 Thomas' (Upper Kandanga)
251 Dagun North
254, 255 Donaldson's No.2
256 Rendell's
257 Arnold's } Happy Valley
258 Kilkivan
259 Mt.Walli No.2
261 Mt. Mooloo
262 Scrubby Ck.
263, 264 Devils Mt.
4733 Cedar Gully
4734 Roberts' (Upper Kandanga)

QUEENSLAND

MARY VALLEY

RJB

From the lithology and fossil locality the strata on portions 39, 40, and 69, parish of Cambroon are considered to be part of an outlier of ?Permian rocks within the Neranleigh-Fernvale Group equivalents. The outlier does not extend far east or west of these portions and the maximum east-west extent would be 1½ miles. In the direction of the strike (north-north-west) the limits of the outlier are indefinite. Little is known of the somewhat inaccessible Forest Reserve 135 to the north of the Cambroon area. However, Mr. J. E. Ridgway (unpublished memorandum to the Chief Government Geologist of 1-9-1936) records "tuffaceous conglomerate and finer sediments with slates" at the head of Casey Creek, 3 miles south-south-west of Imbil, and he correlated these strata with the fossiliferous beds in the Cambroon area. The Casey Creek strata are on the line of strike of the ?Permian sediments at Cambroon. No rocks which could be correlated with the Cambroon ?Permian sediments are recorded in descriptions of gold workings in the Chinaman Creek area south of Cambroon but no detailed study of the geology of the area has been made.

Gympie Group rocks occur to the east and north-east of the manganese belt but the boundary with the Neranleigh-Fernvale Group equivalents is difficult to define. The marginal rocks are partly obscured by alluvium along the Mary River and the lithology of the two rock groups is usually very similar. In general, shales of the Neranleigh-Fernvale Group equivalents are red, purple or cream coloured, whereas the Gympie Group shales are olive green or cream coloured. However, surface silicification tends to mask the original difference in the shales of the two groups. The widespread manganese-staining is a characteristic feature of the Neranleigh-Fernvale Group equivalents. In addition, the rocks of this Group usually exhibit evidence of shearing whereas the deformation of the Gympie Group shales is comparatively slight in this marginal area.

Burns (1961) considered that the junction between the Neranleigh-Fernvale Group equivalents and the Gympie Group "is probably a faulted one". Although some attempt has been made to define the junction during the recent survey, no conclusive evidence of the relationship between the two rock groups could be found. From a comparison of the deformation it is considered that a significant time break separated the deposition of the two groups. This evidence is in keeping with the pre-Devonian age ascribed to the Neranleigh-Fernvale Group in the Brisbane area. No local rock-unit name has been given to the Neranleigh-Fernvale Group equivalents because of the difficulty in defining the limits of the metamorphic succession.

The Kenilworth Bluff trachyte forms a prominent elevated area 3 miles long and one mile wide near the south-eastern margin of the manganese belt. Burns (1961) regarded it as an intrusion, possibly of Tertiary age. The top of the elevated area of trachyte is in the form of a narrow plateau and looking from the vicinity of Kenilworth it can be seen that the level of this plateau roughly corresponds to the plateau area of North Arm Volcanics to the east of Kenilworth. The possibility is suggested that the trachyte at Kenilworth Bluff may represent an outlier of the upper acid phase of the North Arm Volcanics. The scree slope around the trachyte plateau obscures the relationship with the surrounding sedimentary and igneous rocks.

Distribution

The Mary Valley manganese belt extends for a distance of 50 miles, from the Nanango Branch railway line in the north to Conondale in the south. It reaches its greatest width (11 miles) in the Yabba Creek area and most of the deposits have been found in the central section of the belt from Yabba Creek to Mary Creek.

Of the 60 known deposits, 21 are on forest reserves and 39 on freehold land. Fourteen of the deposits in forest reserves are adjacent to tracks, in fire-breaks or in pine tree plantation areas. Twenty-eight of the deposits on freehold land are near roads, on creeks or in cleared land. The inference from this analysis is that there may be undiscovered deposits in the more inaccessible parts of the Mary Valley, particularly in forest reserves. One forest reserve of particular interest in this regard is Forest Reserve 135 between Yabba Creek and the Kenilworth area. Eighteen deposits have been found within two miles of Yabba Creek and seven deposits in the Mt. Walli-Mt. Allan area south of Kenilworth. The intervening area consists almost entirely of forest reserve and no confirmed occurrences of manganese are known in this area which measures 10 miles by 6 miles. It would be surprising if deposits of economic significance do not remain to be found in this area and there may also be deposits in Forest Reserve 256, Forest Reserve 435 and Forest Reserve 124 to the north.

The north-north-westerly trend of the manganese belt reflects the regional strike of the Neranleigh-Fernvale Group equivalents. The deposits are most abundant in the "Jasper-shale facies," of infrequent occurrence in the "Slate-mudstone facies" and are not known in the "Schist facies" (Burns, 1961). The distribution of the deposits is suggestive of an original sedimentary deposition of the manganese. Manganese deposits occur in Neranleigh-Fernvale Group equivalents in the Gladstone, Cairns and Stanthorpe districts, and at Moggill, Fernvale and Kholo near the type area of the Neranleigh-Fernvale Group. The association of deposits of manganese with lower Palaeozoic silicified slates and jaspers in New South Wales (Hall and Griffin, 1959) indicates the remarkably wide distribution of manganese in these lower Palaeozoic meta-sediments in eastern Australia.

In the manganese deposits of the Walcha district of New South Wales, rhodonite sometimes occurs at depth and along the lateral extension of the manganese lenses and L. R. Hall and R. J. Griffin (1959) consider that a genetic relationship exists between the manganese silicates and granitic intrusion. However, the spatial relationship between areas of granite

outcrop and the distribution of manganese deposits recognised in New South Wales is not apparent in the Mary Valley area.

The stratigraphic distribution of Mary Valley manganese deposits is of assistance in defining broad limits for exploration but is of little use in detailed exploration because the concentration of manganese to form economic deposits is controlled by structural features. It would be extremely difficult to work out a detailed stratigraphic succession in the Neranleigh-Fernvale Group equivalents because of the scarcity of outcrop and the lack of reliable marker beds. Manganese deposits usually have jasperoid rocks associated with them but as the jasperoid rocks have a much wider distribution than the manganese deposits this association does not constitute a very useful guide to exploration.

Controls of Mineralization

Structural controls of manganese concentration, though seldom obvious in outcrop, can nearly always be seen when the deposits have been well exposed by open-cut mining. Faults and joints exercise the most important controls although fold structures have influenced manganese deposition in some deposits.

Faults and Joints.—Structural deformation, resulting in the faulting and shattering of the incompetent beds, facilitated transportation and deposition of manganese oxides. Apparently deposition commenced along fault and joint planes and the adjacent rocks were then partially or completely replaced by manganese oxides or silicates. Some of the joint blocks exhibit high grade ore externally but when broken open are found to have "cores" of unreplaced country rock.

Faulting took place both before and after manganese deposition. Post-ore faults, though fewer in number than pre-ore faults, are usually the more obvious of the two because the displacement is small and can be readily measured. Post-ore faults were observed at the *Upper Kandanga, Old Bollier, Quarry* deposit, *Eel Creek, Mt. Walli, Skyring Creek* and *Zachariah Creek* deposits (see figures 4, 5 and 8). Pre-ore and post-ore movement on individual faults appears to have taken place at the *Upper Kandanga* deposit and it is probable that this has taken place in some of the other deposits mentioned. At the *Upper Kandanga* complementary sets of faults strike N.85°E. and N.10°E. and dip 75°N. and 80°E. respectively (see figure 3). At the *Amamoor* deposit faults commonly control the limits of manganese ore. Five directions of faulting were observed and the structural pattern is far more complex than at the *Upper Kandanga.*

The most important group of faults ranges in strike from north-west to north-north-west with steep dips to the south-west or north-east. Other groups of faults range in strike from north to north-north-east and from east-north-east to east. Normal faults are more common than reverse and thrust faults. Faulting in the incompetent siliceous and manganiferous beds is often reflected in the overlying and underlying shales by minor folding and flexuring of the beds.

Folding.—The regional fold pattern is obscure. The only geological information evident from air photo interpretation is the regional strike which is often reflected by ridge directions. Much of the minor folding, seen mainly in artificial exposures, is irregular and cannot be used as a reliable guide to major fold structures. In view of the increase in grade of metamorphism from east to west, the predominance of moderate to steep westerly dips appears to indicate that overturning of the beds has taken place.

The strike of several manganese deposits does not conform to the regional strike of the Neranleigh-Fernvale Group equivalents. These deposits are the *Upper Kandanga* (strike N.80°E, dip 35°N), *Imbil West* (strike N.65°E, dip 35°-50° W.N.W.), *Old* Bollier (strike N.75°E, dip 40°N.N.W.) and *Imbil No.* 2 (strike N.30°E, dip 30° N.W.). The manganese lenses are conformable with the overlying and underlying shales. At the *Old Bollier* minor folds pitching 40° N.N.W. are exposed in the open-cut face. The manganese is of higher grade in the synclinal areas than in the anticlinal areas. It is possible that this process of concentration of manganese in synclinal areas may have taken place on a larger scale and that the above deposits occur in north to north-westerly pitching synclinal structures. Confirmation of this suggestion was not possible because of lack of outcrop.

The manganese deposits appear to have been originally deposited in deep-water sediments and subsequently concentrated to form deposits of economic grade by supergene processes. In general the manganese minerals replaced siliceous sediments along lines of structural deformation. Usually the concentration took place in, or close to, the original manganiferous horizon, as most deposits are conformable with the overlying and underlying beds and the manganiferous horizon can sometimes be traced for a considerable distance along the strike beyond minable limits. The occurrence of andesitic volcanics in the rock sequence containing the manganese deposits may indicate a genetic relationship between the original manganese deposition and submarine vulcanism (Macandie, 1959 and cf. Reed, 1960).

Mineralogy

Manganese Minerals.—Most of the manganese ore is of the hard, dense, massive type suitable for metallurgical purposes. The ores commonly consist of cryptomelane or braunite or a mixture of the two minerals. The typical cryptomelane ore is blue-black with a smooth conchoidal fracture. It has a sub-metallic lustre on fresh faces but tarnishes quickly. Botryoidal cryptomelane ore is not very common but is present in some quantity in the *Mt. Mooloo* and *Scrubby Creek* deposits and was also observed in the

Mt. Allan deposit and at *Waugh's* and *Lowe's* prospects. Oolitic ore was observed only in the small *Cedar Gully* deposit west of Amamoor. The typical braunite ore is grey-black in colour with an uneven fracture. It appears to be slightly harder than the cryptomelane ore. The hard ores are usually very finely crystalline although some rather coarsely crystalline ore occurs in the *Devil's Mountain, Cedar Gully, Milne's* and *Mt. Walli* deposits.

The battery grade ore usually consists of cellular material and is a mixture of soft black pyrolusite and hard, blue-black cryptomelane. γ–MnO_2 may also be associated with pyrolusite in the soft ore. Battery grade ore occurs at the *Eel Creek, Dagun, New Bollier, Rendell's, Mt. Allan, Cedar Gully* and *Grigor's* deposits. Ore from the *New Bollier* and *Rendell's* deposits was readily graded to produce ore with an MnO_2 content exceeding the minimum of 75 per cent., but elsewhere the battery ore is associated with hard ore with a much lower MnO_2 content and considerable experience is necessary to successfully grade the ore.

Soft, black manganese oxides commonly occur as encrustations and coatings on joint blocks of hard manganese ore near the surface. The *Mt. Allan* deposit is the only one to have been worked for battery ore below a depth of 10 ft. In this deposit the ore lens became too narrow to work below a depth of 35 ft. By contrast, the main deposits of metallurgical grade ore, *Amamoor, Imbil West* and *Upper Kandanga,* have persisted to depths of 65 to 70 ft. and the lower limits of these deposits may not yet have been exposed. In general, the longer and wider the manganese lens, the greater the probability that it will persist in depth.

Although, as a general rule, hard ores have a comparatively low MnO_2 content (less than 60 per cent.), ores consisting of crytomelane may have an MnO_2 content of 75 per cent. or more (see Table 2, *Scrubby Creek* sample). Three different types of ore from the *Cedar Gully* deposit were assayed for purposes of comparison of the MnO_2 content (see Table 3). Hard, crystalline, grey-black ore (presumably mainly braunite) contained 47·9 per cent. Mn and 36·9 per cent. MnO_2; hard, massive, blue-black ore (presumably cryptomelane) assayed 53·4 per cent. Mn and 75·4 per cent. MnO_2, and mixed hard and soft ore (presumably crytomelane and pyrolusite) contained 55·6 per cent. Mn and 80·9 per cent. MnO_2 The hard, blue-black, high MnO_2 ore has a smooth conchoidal fracture usually with a network of fine veins of a manganese oxide mineral through the ore.

Ten samples of ore from a wide cross-section of Mary Valley deposits, and as free from visible impurity as possible, were collected with a view to obtaining information on the identity of the manganese minerals in the ores. All the samples were analysed at the Government Chemical Laboratory, Brisbane and X-ray analyses were carried out on six of the samples by the University of Queensland, Department of Mining Engineering. The results of the analyses are set out in Table 2.

In addition to the assays in Table 2, Burns (1951) had 17 samples assayed for BaO content in addition to Mn, SiO_2 and Fe_2O_3 (see Table 3). From the low BaO content of the ores it is concluded that, with few exceptions, psilomelane ($Ba\ Mn_9O_{18}.2H_2O$) is a minor constituent mineral. The only samples of ore containing significant amounts of BaO were from *Amamoor* and *Dagun*. Psilomelane is probably present in these two deposits although its presence has not been confirmed by X-ray analysis.

TABLE 2. ANALYSES OF SELECTED SAMPLES OF MANGANESE ORE

Location	Description of ore	Mn	MnO_2	SiO_2	Fe_2O_3	BaO	K_2O	H_2O-	H_2O+	Total	Minerals present from X-ray analysis
Eel Creek ..	Hard, massive ..	48·96	66·3	3·94	7·15	1·84	0·55	2·91	3·83	95·65	..
Eel Creek ..	Mixed hard and soft; cellular	56·10	82·5	0·53	3·77	1·15	0·38	1·72	2·79	97·96	Pyrolusite, minor cryptomelane
Devils Mount	Hard, crystalline some massive	48·42	46·4	15·69	1·77	2·60	0·44	1·25	1·91	94·72	Braunite, hausmannite, cryptomelane
Scrubby Creek	Hard, botryoidal..	50·46	72·9	0·60	0·72	0·72	3·18	1·19	3·89	88·88	Cryptomelane, minor pyrolusite
Upper Kandanga	Hard, with granular quartz	49·80	59·3	22·50	0·85	0·49	0·04	0·15	0·60	99·81	Braunite
Imbil No. 2 ..	Hard, massive ..	52·14	65·8	9·96	1·88	0·54	0·89	1·03	2·31	96·06	Braunite, minor cryptomelane
Craigs (Yabba Creek)	Hard, massive ..	51·24	71·2	5·41	2·27	0·25	0·82	1·78	3·08	92·81	..
Dagun ..	Hard, massive, some soft cellular	50·80	73·4	5·52	5·40	3·83	0·86	0·75	3·19	98·60	Pyrolusite, minor cryptomelane
Mount Walli..	Hard, crystalline and massive	44·68	39·7	17·78	5·17	0·61	..	..	..	88·55	..
Skyring Creek (M.L. 227)	Hard, massive, some soft	53·23	76·7	0·81	3·14	1·94	..	..	..	88·74	..

Most of the 8 samples assayed for K_2O contained appreciable amounts of this oxide. This indicates that cryptomelane (KMn_8O_{16}) is a constituent mineral in most of the ores and this was confirmed by X-ray analysis. Five of the six samples on which X-ray analyses were carried out contained cryptomelane but it was the dominant mineral in only one of them. From the results of an X-ray study of five samples of hard ore, Burns (1951) concluded that cryptomelane was the most common manganese oxide mineral in the Mary Valley ores. Botryoidal ore from *Scrubby Creek* contained 3·18 per cent. K_2O and this ore was confirmed by X-ray analysis as consisting almost entirely of cryptomelane. Most of the assays indicate that the hard ores consist of intimate mixtures of cryptomelane and braunite with hausmannite, pyrolusite and psilomelane sometimes present.

Braunite ($3Mn_2O_3.MnO.SiO_2$) was identified as the dominant manganese mineral in three of the samples subjected to X-ray analysis and the recent analyses show that it is a more important constituent of the Mary Valley ores than previously recognised. Braunite had been identified earlier in a specimen from the *Amamoor* deposit in which it was associated with piedmontite and pyrolusite (McAndrew and Edwards, 1954). Usually braunite contains an appreciable amount of iron but the Mary Valley braunite ores have a low iron content (usually less than 2 per cent.). The ore in the *Upper Kandanga* deposit consists of braunite with finely disseminated quartz. As a result the average silica assay is very high (22 per cent.) even though the manganese content is fairly high (46 per cent. Mn). Not much reduction in the silica content can be effected by hand-sorting this type of ore.

Hausmannite (Mn_3O_4) was identified in a sample from *Devil's Mountain*. It was also present in association with γ–MnO_2 and pyrolusite in a specimen examined by J. McAndrew and A. B. Edwards (1954). This specimen is thought to have come from the *Mt. Allan* mine although no precise locality was given in the report.

Rhodonite has been identified from several deposits but it is seldom present in quantity. At *Mt. Allan* rhodonite is associated with quartzite which underlies the manganese horizon. No evidence was seen that the deposits of manganese oxides give place to rhodonite at depth as happens in some of the New South Wales deposits (Hall and Griffin, 1959). Piedmontite (manganiferous epidote) associated with braunite was identified from the *Amamoor* deposit (Burns, 1951) but this mineral is of rare occurrence.

Impurities in the manganese ore.—The only impurity to cause concern in the marketing of the manganese ore is silica which is usually present in the form of disseminated grains of quartz or as irregular patches of jasperoid material. Creamy-white chalcedonic silica is also quite common and often occurs as unreplaced "cores" of joint blocks of manganese ore. This is referred to by the mine operators as "bony" ore.

Apart from small, high-grade lenses, the manganese ore has to be hand-sorted before despatch from the mine. In some deposits, such as the *Amamoor, Yabba Creek, Mt. Mooloo, Mt. Allan*, and *New Bollier*, not much difficulty has been experienced in grading the ore, but in other deposits, such as the *Imbil West, Old Bollier, Skyring Creek* (M.L. 227), *Zachariah Creek, Imbil No.* 2, and *Mt. Walli*, it has been found difficult at times to maintain parcels of ore at a grade in excess of the 40 per cent. Mn minimum requirement. Ores from the *Imbil West, Upper Kandanga, Old Bollier* and *Zachariah Creek* deposits have averaged more than 20 per cent. SiO_2, and as silica in excess of 8 per cent. is penalised 1s. 6d. per unit, the deduction for silica in ores from these deposits is substantial.

The iron content of the Mary Valley ores is comparatively low and the ores are rarely, if ever, subject to the penalty for iron in excess of 8·5 per cent. in metallurgical ore. Deposits in the northern part of the manganese belt, particularly around *Mt. Mooloo* have a higher iron content than deposits to the south. Ore from *Mt. Mooloo* has averaged 7·2 per cent. Fe and the *Dagun, Mooloo T.O., Eel Creek*, and *Queen Mary* ores have averaged 3 per cent. to 4 per cent. Fe. Botryoidal hematite is associated with manganese oxides at the *Mooloo T.O.* prospect.

The phosphorus content of the ores is low, ranging from 0·03 per cent. at the *Yabba Creek* deposit to 0·09 per cent. at the *Dagun* deposit. As 0·18 per cent. phosphorus is tolerated in metallurgical ore, the Mary Valley ores are never subject to a penalty for phosphorus content.

Cobalt has not been found in more than trace amounts in manganese ore samples although comparatively few samples have been assayed for this element. A sample containing asbolan from the Pie Creek area (west of portion 1335, parish of Glastonbury) assayed 6·6 per cent. Mn and 7·2 per cent. Co. An unusual mineral association was found in the *Eel Creek* deposit where native copper in wire form was present on a joint plane in manganese ore.

Small amounts of barytes were observed at the *Skyring Creek* (M.L. 227) and *Eel Creek* deposits and barium sulphate was reported in an assay of ore from the *Yabba Creek Ford* deposit. Several samples of barytes have been submitted to the Geological Survey from the area near the headwaters of Amamoor Creek and from Calico Creek between Dagun and Gympie. However, no barytes was present in the samples recently collected or in those collected by Burns (1951) and it is considered that the BaO content of the ores can be attributed to psilomelane.

Table 3. Analyses of Manganese Ores

Location	Sample Reference	Description	Mn	MnO_2	SiO_2	Fe_2O_3	BaO
Amamoor (M.L. 120) from open-cut	A	Soft cellular ore somewhat brownish in colour	56·8	..	1·4	1·4	1·3
		Soft black ore	49·1	..	1·6	0·6	11·8
		Hard massive ore containing *piedmontite* crystals, from small open-cut 100 ft. S.E. of main open-cut	39·5	..	16·2	0·9	3·0
		Hard massive ore from small trench 600 ft. S.S.E. of main open-cut. Near boundary of M.L. 120 and M.L. 227	52·7	..	2·6	0·7	6·4
Cedar Gully (M.L. 4733)	B	Hard, dense, crystalline, grey-black ore	47·9	36·9	11·5	..	..
		Hard, blue-black ore with a smooth, conchoidal fracture and containing soft black Mn oxides in cellular pockets	55·6	80·9	1·3	..	..
		Hard, dense, massive blue-black ore with a smooth conchoidal fracture	53·4	75·4	2·3	..	..
Dagun (M.L. 230) from pit 10 ft. deep	B	Selected sample of cellular ore with some soft Mn oxides in cavities	52·2	77·2	6·8	6·6	..
Eel Creek (M.L. 243) from shallow open-cut	B	Hard, massive, grey-black ore with some cream chalcedonic silica and red jasperoid material	41·5	36·8	26·7	3·8	1·8
Elmer's prospect from shallow pit	F	Hard, blue-black ore with some soft black Mn oxides	45·2	..	1·4	..	3·0
Imbil West (M.L. 159)		Hard, massive ore with associated earthy red material and quartz veins	15·4	..	73·6	0·4	0·1
	A	Hard, massive, blue-black ore with disseminated fine-grained quartz	42·2	..	31·4	0·3	0·3
		Soft black Mn oxides associated with hard massive ore	45·8	..	21·8	0·1	0·2
		Hard, dense, massive, blue-black ore from main footwall lens	45·6	..	18·1	..	..
	B	Hard, dense, massive, blue-black ore with disseminated fine-grained quartz	40·9	..	24·5	..	..
Imbil rail cut prospect— outcrop material	A	Hard, massive, dense blue-black ore	42·4	..	20·3	0·5	0·1
		Hard, massive, blue-black ore with quartz and inclusions of jasper	37·0	..	37·0	0·3	0·3
Mooloo T.O. prospect from shallow trench	A	Hard, massive blue-black ore with a little associated hematite and jasper	47·1	..	11·6	5·8	1·1
Mount Mooloo (M.L. 261)— from shallow open-cuts	A	Hard, dense, botryoidal ore	54·7	..	2·5	1·5	0·5
		Hard, dense, botryoidal ore with associated jasper and iron oxides	36·8	..	26·6	6·9	0·4
Mount Walli (M.L. 124)— from broken ore in main open-cut	B	Hard, massive, blue-black ore with some crystalline ore	48·1	50·3	9·4	5·6	..
	E	Hard ore (1) From main open-cut	49·8	..	11·4	4·6	..
		Hard ore (2) High-grade ore from main ore lens	50·6	..	12·7	4·9	..
		Hard ore (3) From small open-cut on footwall of ore lens	48·8	..	4·9	2·3	..
		Hard ore (4) Average of surface ore	43·5	..	10·5	8·5	..
Old Bollier (M.L. 213). From trench W. of open-cut.	A	Hard, massive ore with disseminated fine-grained quartz	35·2	..	39·6	0·3	0·1
Quarry deposit (M.L. 220)— from open-cut	A	Hard, massive, blue-black ore. Samples of higher grade	52·3	..	5·8	..	..
		and lower grade ore	39·8	..	26·5	2·1	..
Scrubby Creek (M.L. 262)— surface sample	F	Hard, botryoidal ore	49·2	74·8	2·8	1·2	..
Rendells (Happy Valley M.L. 256)—	A	Cellular ore consisting largely of soft black Mn oxides	52·5	80·2	1·3	1·7	2·7
from shallow trench			54·1	83·9	2·7	3·4	..
Skyring Creek (M.L. 227) from open-cuts in N.E. side of creek	D	Hard, massive ore representative of upper 2½ ft. of ore	50·5	59·2	8·8	..	..
		Hard massive ore representative of lower 4 ft. of ore, contains jasperiod material	32·8	30·8	19·5	..	..
Mount Allan (M.L. 104)— from old underground workings	C	Soft black ore with subordinate hard ore	47·9	71·6	3·4	..	..
			53·1	80·3	2·4	..	..
Yabba Creek (M.L. 158) from open-cut	F	Hard, dense blue-black ore with a little disseminated fine-grained quartz	52·2	..	11·6	1·6	..
Yabba Creek Ford—	F	Soft black ore	..	70·0	6·1	..	4·5
from small open-cut		Soft black ore	50·1	..	9·6	..	6·0 ($BaSO_4$)
		Mixed hard and soft ore with associated jasper and quartz	..	56·6	27·2	2·6	3·0
Zachariah Creek (M.L. 162)	A	Hard, dense, blue-black ore with some associated chalcedonic silica and disseminated fine-grained quartz	43·5	..	23·4	5·6	0·5
			46·7	..	18·0	3·3	1·3

A=W. G. Burns (1951). B=J. H. Brooks (1960). C=T. H. Connah (1950). D=T. D. Dimmick (1954).
E=H. I. Jensen (1919). F=Sampled by lessee.

Future Prospects

Known Deposits.—Under the existing system of manganese mining by independent operators, very little attempt is made to prove ore reserves ahead of mining. This is a consequence of unstable market conditions for metallurgical ore and the high cost of diamond drilling in relation to the value of the individual deposits. Proved and indicated reserves (of + 40 per cent. Mn ore) for the Mary Valley are estimated to be less than 3,000 tons. These reserves are in the *Imbil West, Imbil No.* 2, *Upper Kandanga, Mt. Walli* and *Dagun* deposits. In addition the *Devil's Mountain, Milne's* and *Roberts'* deposits contain very small reserves. Deposits which may contribute substantial tonnages of metallurgical grade ore if lower grade ores become marketable or mechanical upgrading becomes practicable, are the *Old Bollier* (4,000 tons) *Queen Mary* (1,500 tons), *Zachariah Creek* (1,000 tons), *Imbil No.* 2 (6,000 tons), *Mt. Walli* (4,000 tons), *Imbil West* (1,000 tons) and *Amamoor* and *Skyring Creek* deposits (7,500 tons). The total estimated tonnage of low grade ore which may be available from these deposits is 25,000.

In addition to the above, the following prospects warrant exploration:—*Grigor's* and other unexplored prospects in the Conondale area, *Adam's, Branch Gully No.* 2, *Soane's, Kandanga Town, Thomas', Waugh's, Smith's, Eel Creek* and *Arnold's.* Judging from what can be seen of these deposits, they do not give promise of containing more than a few hundred tons of marketable grade ore. Some of them are probably worthless but it is possible that one or two may be proved to contain some thousands of tons of ore and it is for this reason that exploration by bulldozing is suggested. As a general rule, any occurrence of floaters of manganese ore in a soil-covered area should be expored by bulldozing or by test pits.

New Discoveries.—The forest reserves are considered to be the best areas to explore for new deposits. The Forestry Department objects to all applications for leases on its reserves but usually satisfactory conditions of lease tenure can be negotiated between the Department and the lease applicant. Usually the manganese deposits can be mined with only minor damage to timber stands. Forestry Department roads have provided valuable access in the reserve areas and as the forest reserves are more fully developed, better access will provide greater opportunity for the discovery and development of manganese deposits.

A locality map accompanying a report by Mr. L. C. Ball (1945) shows several manganese localities which have not been confirmed by inspection. It is thought that the information was supplied by Mr. B. Rodgers who accompanied Mr. Ball on the inspection of *Mt. Allan.* The locations shown on the map are probably only approximate but a search of the areas indicated may prove worthwhile. In particular the localities marked in the little known area of Forest Reserve 135, between Yabba Creek and Mt. Allan, are worth investigation.

Market Prospects.—Although at present reserves are insufficient to warrant the erection of an upgrading plant, it may still be practicable at some future date—by the discovery of new deposits or technical advances in the upgrading of manganese ores—to install a plant to utilise fully the manganese resources of the Mary Valley. The most favourable site for such a plant would probably be Imbil which is in a central position, has a good water supply and is on the Mary Valley railway line.

The decision by Broken Hill Proprietary Co. Ltd. to discontinue buying metallurgical ore at Newcastle as from April 1960 was unfortunate for the manganese mining industry in the Mary Valley as in the preceding two years the industry had been placed on a sounder basis for development than ever before. The effects of the new buying arrangements are discussed in the section on "History and Production".

Mr. T. H. Sanders continued mining operations at the *Upper Kandanga* deposit up to the end of 1960 by which time approximately 1,000 tons of metallurgical grade ore had been stockpiled. The ore will remain in the stockpile till Broken Hill Proprietary Co. Ltd. recommence buying or a market is found overseas.

INDIVIDUAL MANGANESE DEPOSITS

The deposits are described in approximate geographic order from north to south.

Devil's Mountain (M.Ls. 263, 264)

Lessee.—H. Coop; previously held as M.L. 185; also known as Tabke's mine.

Location and Access.—Situated on Platt's property 1·75 miles south of Devil's Mountain on a low east-south-east trending spur 3 miles east-south-east of Woolooga on the Nanango branch railway line; portions 86 and 90, parish of Brooyar.* A vehicle track leads north to the deposit from the Gympie-Woolooga road at a point 0·3 mile from the junction with the Widgee-Woolooga road. The distance to Gympie by road is 19 miles.

Geology and Workings.—1. Deposit on crest of spur. The ore is hard, dense, lustrous, grey-black and crystalline with some hard, dull massive ore (braunite, hausmannite and cryptomelane). Most of the manganese ore exposed is of marketable metallurgical grade although the silica content is high. Some finely granular quartz, rhodonite and clay is present. The country rocks consist of purplish-grey, indurated mudstone with a blocky joint pattern. The strike is north-west and the dip is to the south-west at a moderately steep angle. Massive white quartzite crops out on the neighbouring ridges.

* All the deposits are in the County of Lennox with the exception of the Mt. Walli deposits which are in the County of March.

A considerable amount of bulldozing has been carried out to remove overburden. The open-cut area is 25 ft. long, 12 ft. wide and 10 ft. deep. Manganese ore is exposed over a length of 30 ft. and a width of 3 to 4 ft. Ten tons of ore have been produced and there is about 15 tons of marginal grade ore at grass. Some further development of the deposit could be undertaken although no large tonnage of ore could be expected.

2. Deposit on southern slope of spur. The ore is hard, dull, blue-black and massive and often has encrustations of soft black manganese oxides. Some joint blocks have encrustations of hard, blue-black, lustrous botryoidal ore. A bulldozed open-cut 50 ft. long, 20 ft. wide and 8 ft. deep was partly filled with water and no manganese ore could be seen *in situ*. Prospects of production from this deposit are poor.

Assays of samples of Devil's Mountain ore collected by Mr. Tabke and others are as follows:—

Mn	SiO_2	Fe	P_2O_5
37·0	16·9	4·0	0·3
38·9	12·7	5·2	..
47·5	12·5	1·4	..
50·5	14·5	1·3	Trace

Kilkivan (M.L. 258)

Lessee.—R. Staines.

Location.—Four miles south of Kilkivan on Waldock's property, portion 63, parish of Kilkivan; on the divide between Coppermine Creek and Wide Bay Creek. Access is from the Kilkivan-Goomeri road by vehicle track, the distance to Kilkivan by road being 5 miles.

Geology and Workings.—Manganese has been found at three points over a north-south distance of about one mile. On M.L. 258 bulldozing was carried out over a length of 2 chains to investigate the persistence at depth of two large slabs of hard, siliceous manganese ore which cropped out near the crest of a hill. The manganese occurrence proved to be superficial and no production took place. The manganese is associated with jasper and the country rocks are olive-green shales. Some serpentine and magnesite have also been exposed by the bulldozing. About ½ ton of dull, blue-black, siliceous ore is stacked nearby.

Half a mile south of M.L. 258 on portion 64 there is an open-cut from which 54 tons of ore were produced in 1918-19. The deposit was described by Denmead (1944).

Samples from the deposit submitted to the Geological Survey by the lessee assayed as follows:—

Mn	Fe	SiO_2	P
53·9	1·1	0·6	0·05
44·1	1·4	14·8	0·07
27·0	4·5	20·4	0·05

Half a mile north of M.L. 258, a small lens of hard, siliceous manganese ore is exposed in a pit 6 ft. long, 3 ft. wide and 3 ft. deep. The manganese is associated with jasper in a succession of slates.

Prospects of further production from these occurrences are poor.

Sexton

A sample submitted to the Geological Survey from portion 1142, parish of Brooyar assayed 52·1 per cent. Mn, 7·5 per cent. SiO_2, 0·5 per cent. Fe and 0·05 per cent. P. Sexton is a siding on the Nanango branch railway line. The occurrence has not been confirmed by inspection.

Laver's Prospect (M.L. 221)

Lessees.—H. B. Trigger and W. J. O'Neill.

Location and Access.—Situated 2·5 miles south-east of Upper Widgee T.O.; portion 132, parish of Widgee, adjacent to Forest Reserve 242. Access is from Hawkins' road which diverges south from the Gympie-Widgee road. The distance by road to Gympie is 15 miles.

Geology and Workings.—The ore is of the hard, dull, grey-black type. Some disseminated fine-grained quartz is present but the main impurity is milky quartz which occurs as veins up to a few inches in width. Only a small proportion of the manganese lens is of marketable grade. The country rocks are red silicified shale and jasper which strike N.5°W. and dip almost vertically. Manganese ore is exposed over a length of 70 ft. and a width of 4 ft. Some shallow bulldozing has been carried out around the deposit and a shallow pit near the northern end has exposed siliceous manganese ore which was stated to have assayed 38 per cent. Mn. The deposit could not be economically developed under existing conditions.

Two samples submitted to the Geological Survey from the *Glastonbury Forest Reserve* 242 assayed 35·0 per cent. Mn and 52·6 per cent. Mn respectively. The precise locality is not known.

Smith's Prospect (M.L. 232)

Lessees.—F. N. and R. N. Smith.

Location and Access.—Situated on "Mountain View" farm, 1·3 miles south-east of Glastonbury; on subdivision 1, portion 1498, parish of King. Access is from the Gympie-Glastonbury Road by vehicle track which extends to the base of the hill below the deposit. The distance to Gympie by road is 10 miles. The deposit crops out on a narrow northerly spur near the top of a prominent hill.

Geology.—The ore is of the dense, hard, dull, grey-black type with some lustrous, blue-black ore. Impurities consist of irregular patches of cream chalcedonic silica with minor amounts of vein quartz and iron oxide. Some of the boulders on the steep hill slope contain fairly high grade metallurgical ore but only a small proportion of the ore *in situ* is of marketable grade. Developmental work has been confined to the excavation of a few shallow pits. This has indicated that most of the joint blocks of ore have siliceous "cores". The main outcrop area is

80 ft. long and 10 ft. wide and appears to have a north-south strike. Manganese-stained jasper crops out to the south of the deposit and to the north a porphyritic trachyte, intruded by a basic igneous rock, is exposed.

It is unlikely that the deposit could be profitably developed under present conditions but it may warrant further testing under more favourable market conditions.

Scrubby Creek (M.L. 262)

Lessee.—H. Coop.

Location and Access.—On Marks' property adjacent to an old track which diverges east from the Scrubby Creek road near Waugh's farmhouse; resubdivision 2 of subdivision 9, portion 1339, parish of King. Access is from the Gympie-Glastonbury Road and the distance to Gympie by road is 8 miles.

Geology.—Hard, botryoidal and stalactitic ore (cryptomelane) occurs as encrustations up to several inches thick on boulders of jasper. The ore is of high grade and the main impurity is ferruginous clay which partly fills the voids in the ore. No outcrop of manganese ore was observed and the boulders were apparently shed from the hill slope beyond the lease area. The high-grade manganese ore would amount to only a few tons.

Floaters of manganese-stained jasper and manganese ore are of frequent occurrence in the area near M.L. 262 and this may indicate the presence of concealed bodies of manganese ore. However, as most of the area is under cultivation there is not much incentive to carry out exploratory work.

High-grade manganese ore is reported to have been found in a well near a creek on subdivision 17 of portion 1519, parish of King. No inspection of this occurrence was made.

Waugh's Prospect

Location and Access.—Situated south-east of M.L. 262 on portion 1519, parish of King; in a spring-fed gully on the higher northern slopes of Mt. Stratigos. Access from the Scrubby Creek Road is by a four-wheel drive vehicle track through Waugh's property.

Geology.—Two small outcrops, a few hundred yards apart, were inspected. The south-easterly outcrop consists of fairly high-grade botryoidal ore with some ferruginous clay impurity. The outcrop is 4 ft. in diameter and quartz-veined, massive jasper boulders are strewn round about. The occurrence is worth opening up to determine its full extent. As it is situated at the edge of an area intended for cultivation exploratory pits should be sunk before any bulldozing is carried out. A sample taken from the outcrop by Mr. Waugh assayed 57·8 per cent. Mn and 0·6 per cent. SiO_2.

The second outcrop is about 3 ft. in diameter and consists of manganese-stained jasper with some pockets of siliceous manganese ore and hard, blue-black, metallurgical grade ore. The prospects of locating a workable deposit here are not very favourable although some further exploratory work is justified.

Queen Mary (M.L. 229)

Lessees.—H. B. Trigger, W. J. O'Neill and W. Milne. Previously M.L. 97 and 103 (Mt. Nansen and Mary Creek).

Location and Access.—Eight miles south-west of Gympie; on the eastern boundary of Forest Reserve 124, parish of Glastonbury; on the steep south bank of Mary Creek. A forestry road which continues on from the Mary Creek Road traverses the lease. The distance by road to Gympie is 10 miles.

Geology and Workings.—Hard, grey-black, siliceous ore remains in the open-cut although it is reported that the ore produced was of high grade. Most of the manganiferous horizon consists of manganese-stained or encrusted joint blocks with some pockets of marginal, metallurgical grade ore. The joint blocks consist of jasper and chalcedonic silica with veins of white quartz. A strike fault occurs on the hanging-wall of the manganiferous horizon. The country rocks are massive, white quartzite and silicified, thick-bedded shales. The beds strike N.20°W. and dip 30° to 55° S.W.

The workings extend over an area 80 ft. long and 50 ft. wide and to a maximum depth of 17 ft. They consist of small open-cuts, trenches and two short, connecting adits. A shaft 39 ft. deep is situated 70 ft. south-west of the open-cut area. It is now inaccessible but from the absence of manganese ore on the dump the shaft was probably not sunk deep enough to test the possible extension of the deposit down-dip.

This was the first deposit in the Mary Valley from which manganese ore was produced. One hundred and eighty-seven tons of ore were mined in the 1908-10 period but no production has since taken place.

Analyses of samples of ore are as follows:—

Mn	MnO_2	SiO_2	Fe
44·1	66·1	8·6	2·7
43·5	..	9·4	5·9

There are indications of a significant tonnage of siliceous ore in this deposit and it may warrant further development if lower grade ores become marketable. This development would probably involve the re-routing of the Forestry Department Road.

Milne's Prospect (M.L. 212)

Lessees.—W. J. O'Neill, W. Milne and H. B. Trigger.

Location and Access.—Seven miles S.W. of Gympie on resubdivision 8 of subdivision 5, portion 1386, parish of Glastonbury; on a steep south-easterly slope of a ridge extending from Mt. Stratigos. Access is from the Mary Creek Road. No track exists from the road up the steep slope to the lease which is adjacent to the boundary of Milne's property. The distance to Gympie by road is 9 miles.

Geology and Workings.—A lens of hard, blue-black crystalline ore with subordinate amounts of massive ore occurs within a horizon of jasperoid rock which is overlain by brown weathered andesite. Quartz-epidote veins traverse the jasperoid rock horizon. The manganese lens strikes N.25°W. and dips 45°S.W. The

main impurity in the ore is cream chalcedonic silica. A 6-ft. face of rock and soil has been exposed over a length of 50 ft. Metallurgical ore is exposed over a length of 10 ft. and a width of 3 ft., but this may not represent the full extent of the deposit. Some ten tons of ore are at grass. Although the deposit appears small, further exploratory work is warranted.

Donaldson's Deposit (M.L. 242)

Lessees.—T. H. and M. A. Sanders (transferred from J. & P. M. Rasmussan).

Location and Access.—Six miles S.S.W. of Gympie; portions 364, 679 and 813 parish of Glastonbury; on a north-south trending ridge near Donaldson's house. Access is from the Mary Creek Road by a bulldozed track. The distance to Gympie by road is 7·5 miles.

Geology and Workings.—The ore is of the hard, massive, lustrous, blue-black type with some hard, dull, black ore. Cream chalcedonic silica is the main impurity. Irregular almond-shaped lenses of manganese ore occur in a manganese-stained jasperoid rock. Two lenses were exposed at the time of inspection, one of which is 10 ft. long and 4 ft. wide. This is apparently the remnant of a larger lens from which 25 tons of metallurgical ore were produced. The ore assayed approximately 46 per cent. Mn and 15 per cent. SiO_2.

The open-cut is 75 ft. long, up to 30 ft. wide and 9 ft. deep. There may be concealed lenses of ore in the vicinity of the exposed lenses but the cost of further developmental work would be high in relation to the expected size of the ore lenses.

M.L. 254, 255 (J. & P. M. Rasmussan).—These are adjacent leases just south of M.L. 242. Manganese-stained and encrusted jasperoid rocks crop out on the western side of the same ridge on which *Donaldson's* deposit is located. Chalcedonic silica, quartz and rhodonite are associated with the manganese oxides. Some bulldozing was carried out but this did not expose any marketable ore.

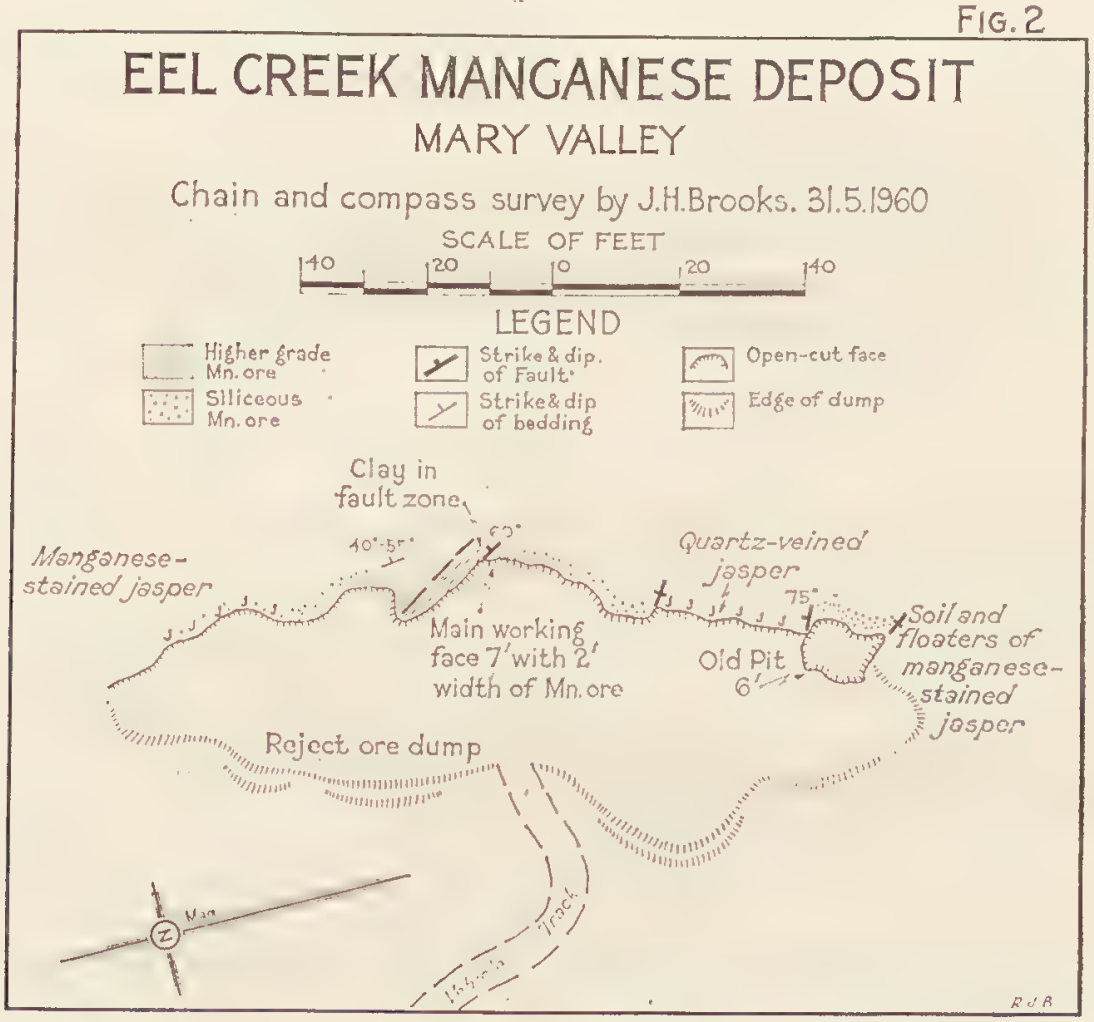
Eel Creek (M.L. 243)

Lessees.—T. H. and M. A. Sanders (transferred from J. and P. M. Rassmussan; previously M.L. 121 (W. J. O'Neill) and M.L. 214 (J. G. Craig).

Location and Access.—Adjacent to the Eel Creek Road, 9 miles south-west of Gympie; in portion 362, parish of Glastonbury. The land has been largely overgrown by lantana. The distance to Gympie by road is 12 miles.

Geology and Workings.—Both metallurgical and battery grade ore has been produced from this deposit. The metallurgical ore is hard, massive grey-black and lustrous (cryptomelane) and is usually ironstained. The battery ore consists of hard, lustrous, blue-black, cellular material with pockets of soft black manganese oxides (pyrolusite and cryptomelane). The principal impurities in the ore are cream chalcedonic silica and jasper which often form siliceous "cores" to joint blocks of ore. A little barytes and rhodonite are also present. Native copper in wire form was found on a joint plane in this deposit.

FIG. 2



The country rocks are coarsely-banded jasper and massive quartzite which strike N.25°W. to N.10°W. and dip 60° to 85°E. Minor folds pitch 75°N. Quartz and quartz-epidote veins are of common occurrence in the jasper and manganese staining is widespread.

Three pockets of ore are exposed in the open-cut which is 115 ft. long, 30 ft. wide and 7 ft. deep. (See Figure 2.) After 175 tons of ore were produced from the southernmost pocket in 1949 it was thought that the deposit was worked out. However, bull-dozing by Sanders in 1959 exposed two other small lenses of ore separated by cross-faults, and a further 43 tons of ore were produced in 1960.

It is possible that there may be other concealed bodies of manganese ore separated from the known lenses by cross-faults. The prospects for exploration to the south appear more promising than those to the north.

It is reported that small outcrops and floaters of manganese ore occur in jasper and quartzite west of M.L. 243 on Groundwater's property (Macandie, 1958).

Mooloo T.O. Prospect

Location and Access.—On Woolgar's property; portion 38, parish of Amamoor, one mile N.E. of Mt. Mooloo and 8 miles south of Gympie. Access from the Mooloo Road is by vehicle track. The distance to Gympie by road is 11 miles.

Geology and Workings.—Hard, massive, lustrous blue-black manganese ore is associated with jasper and botryoidal hematite in a succession of red silicified shales. Slickensiding was observed on several faces of ore. Jasperoid manganese ore is exposed over a length of 50 ft. and a maximum width of 7 ft. in a bulldozer cut 54 ft. long, 24 ft. wide and 9 ft. deep. A trial parcel of ore is reported to have assayed 42 per cent. Mn and a selected sample assayed 47·1 per cent. Mn, 5·8 per cent. Fe_2O_3 and 11·6 per cent SiO_2.

In view of the marginal grade of the ore and the proximity of the prospect to cultivated land, further exploration does not appear justified at this stage. Other small outcrops of manganese ore are reported to occur in this area but these were not inspected.

Plate's Prospect (M.L. 236)

Lessees.—H. Coop and R. J. Marshall. Previously known as the "McDougall" M.L. 101 and the "Homeward Bound".

Location and Access.—Less than 1 mile north of Mt. Mooloo, 9 miles south-south-west of Gympie; on portion 45, parish of Glastonbury. Access is by a vehicle track which diverges from the Eel Creek Road at Coppermine Creek. The total distance to Gympie is 12½ miles.

Geology and Workings.—The recent inspection of this lease was hampered by the dense growth of lantana but Shepherd (1938) described the deposit and no developments have taken place since that time. Hard, massive, blue-black manganese ore occurs within a succession of jasper and jasperoid quartzite. Floaters of micro-diorite were observed on the hill-slope below the deposit. A small lens of siliceous manganese ore is exposed in a pit 30 ft. long, 12 ft. wide and 3 ft. deep. Prospects of production from the deposit are not very favourable.

Mt. Mooloo (M.L. 261)

Lessee.—H. Coop. Previously M.L. 47 and 102.

Location and Access.—10 miles south-south-west of Gympie on portions 46 and 47, parish of Glastonbury; just north of the crest of Mt. Mooloo (1,425 ft.). Access is from the Eel Creek or Pie Creek roads, the distance to Gympie being 13 miles. No vehicle track exists from these roads to the top of the mountain. The early production of ore was handled by bullock-wagon.

Geology and Workings.—No recent work has been carried out on the deposit and the following description is based on that of S. R. L. Shepherd (1938) and W. G. Burns (1951). The manganese lenses crop out just west of the crest of a north-south trending jasper ridge. Chert and red shale are inter-bedded with the jasper.

There are two trenches on the deposit. The southern trench is 45 ft. long and up to 9 ft. deep. It exposes a lens of high-grade ore over a width of 2 ft. The hard, blue-black ore often has a botryoidal form (cryptomelane). The lens appears to strike north-west. The northern trench, 300 ft. away, is 50 ft. long, 7 ft. wide and 5 ft. deep. It exposes a manganese lens 5 ft. wide which strikes N. 15°W. Soft pyrolusite-type ore is associated with hard, massive ore.

Eighty-one tons of ore produced in 1915 averaged 50·3 per cent. Mn, 7·4 per cent. Fe and 1·9 per cent. SiO_2. A small tonnage of battery grade ore may also have been produced but no precise data are available.

Although the manganese lenses in this deposit contain some fairly high grade metallurgical ore, they are of comparatively small size and in view of the difficulty of access the prospects of further development on an economic basis are poor.

Dagun (M.Ls. 234, 247)

Lessees.—T. H., M. A. and M. Sanders and D. H. Leitch (M.L. 234) and T. H. and M. A. Sanders (M.L. 247). Also referred to as "Big Baldy". Previously M.L. 125, 126.

Location and Access.—½ mile W.N.W. of Dagun; near "Hillview" homestead; on resubdivision 52 of subdivision 1, portion 1352, parish of Amamoor. Access is by the vehicle track to "Hillview" homestead from the western road from Dagun to Amamoor. The distance to Dagun is 1 mile.

Geology and Workings.—Pockets of manganese ore crop out over a distance of nearly a quarter of a mile in a north-north-west to northerly direction. Most of the ore is of the hard, massive blue-black type (cryptomelane, psilomelane) and the remainder is coarsely-cellular with soft black manganese oxides in the cavities (pyrolusite, cryptomelane?). A small amount of battery ore could probably be graded from the metallurgical ore. The country rocks are jasper and red shales.

Several pits have been sunk on the deposit. The southernmost pit, south of the farmhouse, is 20 ft. in diameter and 8 ft. deep. Most of the ore produced came from this pit which is now overgrown by lantana. To the north of the farmhouse there is a group of 4 pits within an area 80 ft. long and 65 ft. wide. The pits are 8 to 10 ft. in diameter and range from 6 ft. to 11 ft. deep. In each pit remnants of pockets of manganese ore are exposed. Jointing appears to have been the main control of manganese concentration in this deposit. Most of the ore is siliceous although some marketable ore could be graded from the dump material. Across a gully 200 yd. north of these workings another pit 9 ft. in diameter and 10 ft. deep exposes another small pocket of manganese ore. Between these workings two bulldozer cuts have been made but these did not expose any ore of marketable grade.

Production amounted to more than 100 tons but the precise figures are not known. No production has taken place in recent years. Ore samples assayed as follows:—

	Mn	Fe	SiO_2	P
Highest Grade ..	54·9	3·5	..	0·10
Lowest grade ..	40·5	4·2	..	0·12
Average Grade ..	48·0	3·5	4·5	0·09

There appear to be good prospects that concealed pockets of manganese ore exist along this line of manganese mineralization but they can only be expected to yield a small tonnage of ore. The proximity to the farmhouse is a deterrent to further exploration and development.

Cole's Prospect (M.L. 251)

This prospect leased to L. N. and V. M. Cole is situated ½ mile north of M.L. 234 on subdivision 1 of resubdivision 56 of subdivision 1, portion 1352, parish of Amamoor. Access is from the same road as for M.L. 234.

Floaters of siliceous manganese ore and manganese-stained jasper occur on a southerly hillslope over an area 40 ft. in diameter. Prospects for development are unfavourable.

Dagun Road Prospect

This prospect is ¾ mile N.N.W. of Amamoor on subdivision 34 of portion 1352, parish of Amamoor, 200 ft. east of the western road from Dagun to Amamoor. The manganese outcrop is overgrown by lantana.

Manganese-stained jasper and siliceous manganese ore extends in a north-south line for a distance of nearly 200 ft. The ore is of the hard, massive, dull, blue-black type with some encrustations of botryoidal ore on joint faces. Quartz, white clayey material and jasper are present as impurities.

The prospects for production from this deposit are very poor.

Zachariah Creek (M.L. 162)

Lessees.—L. W. Coop, H. Coop and B. Soanes; previously Rewa M.L. 99.

Location and Access.—4½ miles W.N.W. of Amamoor; adjacent to a Forestry Department track on the divide at the head of Zachariah Creek; on the boundary of portion 76, parish of Amamoor and Forest Reserve 435. Access is by a forestry track north from the school on the Amamoor Creek Road. The access track passes close to the open-cut on M.L. 120. The distance to Amamoor is 6 miles.

Geology and Workings.—A manganiferous lens on this lease strikes N.70°E. and dips 80°S. A fault which strikes N.80°W. and dips 80°N. divides the ore lens into eastern and western sections. The western section is exposed over a length of 30 ft. and a width of 6 ft. to 8 ft. and is separated from the eastern section by a distance of 45 ft. The eastern section is 35 ft. long and 6 ft. to 8 ft. wide. The hard, massive, lustrous blue-black ore usually contains patches of chalcedonic silica and some finely disseminated silica. The country rock is a greenish-brown, very weathered andesite.

An adit was put in 45 ft. below the crest of the spur in a northerly direction for a distance of 38 ft. Manganiferous rocks were penetrated from 14 ft. from the portal to the end of the adit. Within this 24 ft.

wide section there are several patches of siliceous manganese ore in a manganese-stained siliceous rock. Strike and transverse faults appear to control the concentration of manganese oxides. In addition, jointing is well developed, the most prominent direction being N.80°E. with a dip of 20°–25°S.

The eastern section of the deposit has been explored by two bulldozer cuts. In addition to the main manganiferous lens, a small parallel lens is exposed in the northern end of the top bulldozer cut. A trial parcel of 16 tons of ore sent away in 1959 assayed less than 40 per cent. Mn. The existing exposures do not give much encouragement for the further development of the deposit unless lower grade ore becomes marketable.

Along the divide between the Amamoor Creek and Eel Creek several flows of andesite interbedded with quartzite are exposed in road cuttings. About 2½ miles along the track west from the Zachariah Creek deposit a fine to medium-grained sub-basic intrusive rock is exposed in road cuttings for a distance of over a quarter of a mile.

Langshaw (M.L. 231)

This prospect, leased to L. W. C. Coop, H. Coop and B. Soanes is situated about 1½ miles south-west of *Zachariah Creek* deposit near the forestry track along the divide between Amamoor Creek and Eel Creek; on Forest Reserve 435, parish of Amamoor. The lease could not be found but the lessees reported that exploration by bulldozing failed to expose any marketable ore.

Amamoor (M.L. 120)

Lessee.—W. J. O'Neill; worked on tribute by T. H. Sanders; previously M.L. 73, 88; sometimes referred to as the "Skyring Creek" mine and known earlier as the "Black Magic" mine.

Location and Access.—Three- and a-half miles west of Amamoor in a fire-break area in Forest Reserve 435, parish of Amamoor; on a fairly steep north-easterly slope near the divide between Skyring Creek and Zachariah Creek. Access is by a forestry track north from the school on the Amamoor Creek road. The distance to Amamoor is 5 miles.

Geology and Workings.—The geology and early workings have been described by Mr. C. C. Morton (1929). Although the deposit has been extensively opened up since that time, the geology is still far from clear because of the confused state of the open-cut workings.

Several lenses of manganese ore have been mined. They are usually associated with silicified red and cream shales and impure quartzite. The manganese ore-shale-quartzite horizons are overlain and underlain by weathered andesite. The andesite ranges in degree of weathering from a tough, green, fine-grained rock which may be vesicular, to a soft greenish-brown or yellowish-brown clay rock. Even the freshest material available when examined in this section was found to be weathered and the feldspars indeterminable.

The open-cut which extends over an area 300 yd. long and 75 yd. wide is elongate in a north-north-westerly direction (see sketch plan, Morton, 1929). This corresponds to the regional strike of the Neranleigh-Fernvale Group equivalents. However, the manganese lenses range in strike from north-west to north-north-east, and the concentration of manganese oxides appears to have been determined by strike and transverse faults. In the largest ore lens marketable ore persisted to at least 70 ft. below the natural surface. The ore is of the hard, massive, blue-black type (cryptomelane and psilomelane?) with a minor amount of cellular ore and soft black ore (pyrolusite). More than half the total production of nearly 12,000 tons has been won from the main ore lens which has been worked over a length of 120 ft., a maximum width of 20 ft. and to a depth of 70 ft. from the surface. Approximately half the ore in the lens was of marketable grade. The lens strikes N.8°E. and dips 75°W. to vertical. It is terminated on the northern and southern ends by vertically dipping cross-faults. The footwall and hangingwall also show evidence of faulting although shale beds overlying the manganese lens appear to be conformable.

At least six other smaller lenses of manganese ore were developed. These ranged from 75 ft. long and 8 ft. wide to 40 ft. long and 6 ft. wide. They persisted to depths of up to 30 ft. and the proportion of reject ore to marketable grade ore usually exceeded 2:1. In an open-cut face on a lens of siliceous ore at the northern end of the open-cut area three directions of faulting were in evidence, namely, north-south, and steep west, vertical or steep east dips; north-north-east to north-east, and 50°–70°S.E.; north-west to north-north-west and 45°S.W. to 80°N.E.

Open-cut, Skyring Creek (M.L. 227) in Forest Reserve 435.

Production and Reserves.—Since mining commenced in 1920 a total of 11,917 tons has been produced. A fairly high grade has been maintained although the silica content of some of the 1957-59 ore incurred small penalties. About 6 tons of battery grade ore were produced in 1959 by careful handpicking of the ore.

Probably several thousand tons of 30 per cent.–40 per cent. Mn ore remain in the deposit and broken on reject ore dumps, but the amount of marketable ore in sight is very small. Mining operations were discontinued in 1959 because the operator considered that no significant amount of ore remained which could be economically extracted. In view of the importance of faulting in ore localisation in this deposit it is probable that concealed lenses of marketable ore remain. However, without a very careful study of the open-cut area it would be difficult to know where to begin further exploratory work.

Skyring Creek (M.L. 227)

Lessees.—T. H. and M. A. Sanders; previously M.L. 90; referred to as the "H.Q." by T. D. Dimmick (1954).

Location and Access.—Three miles west of Amamoor; adjacent to M.L. 120 in Forest Reserve 435, parish of Amamoor; the lease straddles Skyring Creek. Access is as for M.L. 120; bulldozed tracks diverge from the main forestry track 1·7 miles from the Amamoor Creek road turnoff.

Geology and Workings.—The ore is of the hard, massive, lustrous blue-black type with minor amounts of cellular ore and soft black ore. Inclusions of jasper and irregular patches of quartz are the main impurities and rhodonite and barytes were also observed. The country rock is a greenish-brown, well-jointed, weathered andesite.

No. 1 Open-cut area (on north-eastern side of Skyring Creek). The manganese lens developed in this open-cut is divided into six sections by cross-faults. The open-cut is nearly 500 ft. long but the aggregate length of the six sections of the ore lens would be about 150 ft. and the average width 4 ft. The maximum face height of the open-cut is 15 ft. The strike ranges from N.50°W. to N.15°W. and the dip is north-easterly at 45° to 60°. On a previous inspection of this deposit (1958) the only workings consisted of five trenches distributed over a distance of 240 ft. The results of sampling one of these trenches are given in Table 3. A sample submitted by the lessees in 1953 assayed 42·4 per cent. Mn and 22·0 per cent. SiO_2.

No. 2 Open-cut area (between the forestry track and Skyring Creek). Bulldozing to remove soil cover has extended over an area 4 chains in diameter. Several small lenses of manganese ore have been open-cut to a shallow depth.

No. 3 Open-cut area (on south-western side of forestry track). The soil cover has been bulldozed from an area 3 chains long and 2 chains wide. Manganese ore is exposed discontinuously over a length of 135 ft. in an open-cut with a maximum face height of 8 ft.

Most of the production of 510 tons of metallurgical ore in the 1959-60 period was obtained from the No. 1 Open-cut area. The ore was difficult to grade by handpicking and the proportion of reject ore to marketable ore usually exceeded 3:1. The operators reported that in the latter stages of mining the nett return from the manganese produced was small. A parcel of 4·5 tons of battery grade ore which was selectively graded mainly from the No. 3 Open-cut area, assayed 75 per cent. MnO_2. Further mining could not be profitably undertaken under present economic conditions.

Skyring Creek (M.L. 228)

Lessees.—T. H. and M. A. Sanders.

Location and Access.—Three miles west of Amamoor, ¼-mile north of the No. 1 Open-cut area on M.L. 227, Forest Reserve 435, parish of Amamoor; on a steep south-south-easterly trending spur. Access is by a steep track from Skyring Creek to the crest of the spur.

Geology and Workings.—The geology is similar in most respects to that on M.L. 227. A greenish-grey andesitic rock containing amygdules and fine veins of calcite crops out on the access track. On the crest of the spur near the open-cuts there is an outcrop of massive hematite quartzite.

Small outcrops of manganese ore on the eastern and western sides of the steep spur have been explored by bulldozing. On the eastern side of the spur a bulldozer cut 80 ft. long has exposed a thick-bedded, manganiferous jasperoid rock which strikes N.25°W. and dips 18°W.S.W. The beds are gently flexured. Two large joint blocks which formed the original outcrop of siliceous manganese ore were found to be isolated blocks and no marketable ore has been exposed by bulldozing. A second bulldozer cut higher up the eastern slope of the spur is 50 ft. long and exposes manganese-stained jasperoid beds over a length of 22 ft. and a width of 4 ft. At the southern end a faulted junction between these beds and soft weathered andesite is exposed.

On the western side of the spur a bulldozer cut 140 ft. long has exposed very siliceous manganese ore over a length of 22 ft. and a width of up to 6 ft. A total thickness of 30 ft. of jasper and manganiferous jasper is exposed in the bulldozer cut. The strike is north-north-west and the dip 50° to 70° east. Thus there appears to be a synclinal axis approximately along the line of the spur. A parcel of 10 tons of ore was produced from a near-surface lens of metallurgical grade ore, a sample of which assayed 45 per cent. Mn and 19 per cent. SiO_2. The prospects of further production from this lease are not very favourable although there are other small outcrops of manganese ore nearby which warrant some exploratory work.

Elmer's Prospect

This prospect is situated 1¼ miles west-south-west of Amamoor, 0·3 miles south of the Amamoor Creek Road on portion 1025, parish of Amamoor.

The ore is of the hard, massive, blue-black type with some soft, black material. The country rocks are red shale and jasper. A sample of ore taken from a shallow pit assayed 45·2 per cent. Mn, 1·4 per cent. SiO_2 and 3·0 per cent. BaO. However, the prospect is too small to be of economic interest.

In 1957, Mr. T. H. Sanders bulldozed another small outcrop of manganese ore on portion 1021, a third of a mile east-north-east of Elmer's prospect, but no significant tonnage of marketable ore was exposed.

Cedar Gully (M.C. 4733)

Lessees.—R. J. Marshall and P. Flood.

Location and Access.—Five miles west of Amamoor; on Forest Reserve 435, parish of Amamoor. The deposit is adjacent to a forestry track to the Cedar Gully pine tree plantation from the Amamoor Creek Road. The distance by road to Amamoor is 8 miles.

Geology and Workings.—Manganese ore is exposed in a bulldozer cut over a length of 50 ft. and a maximum width of 5 ft. The ore is of the hard, massive siliceous type and is interbedded with quartzite which strikes N.45°W. and dips 30°-40° S.W. A small lens of siliceous ore occurs about 12 ft. stratigraphically above the main lens. The bulldozer cut extends over a length of 140 ft. adjacent to the forestry track and the maximum face height of the cut is 8 ft. In the ore paddock three distinct types of ore are present: (1) hard, blue-black oolitic ore, (2) hard, massive, blue-black ore and (3) hard lustrous, crystalline, blue-black ore. Some of the oolitic ore has been partly oxidised to soft black ore. (See Table 3.)

Eighty tons of metallurgical ore were produced in 1959 but the grade averaged less than 40 per cent. Mn. Ten tons of battery grade ore assaying 79·5 per cent. MnO_2 was also produced. About 5 tons of ore remains at grass. Prospects for further production from the open-cut are poor.

A sample submitted to the Geological Survey from *Stoney Gully* which is adjacent to Cedar Gully assayed 48·5 per cent. Mn, 8·8 per cent. SiO_2, 2·6 per cent. Fe and 0·10 per cent. P. The occurrence has not been confirmed by inspection.

Hidden (M.L. 238)

This prospect, leased to T. H. and M. A. Sanders, is 4½ miles W.N.W. of Kandanga on portion 105, parish of Amamoor, in cleared land overgrown by lantana near the divide between the Amamoor Creek and Kandanga Creek watersheds. Access is by vehicle track from the Amamoor Creek Road. Outcrops and floaters of quartz-veined jasper, siliceous manganese ore and white quartzite occur over the lease area. Nothing to encourage expenditure on exploration was seen during the inspection of the lease but it would be necessary to clear the lantana before a proper appraisal of the prospect could be made.

Rendell's Deposit (M.L. 256)

Lessees.—T. H. and M. A. Sanders; previously M.L. 137 (Happy Valley).

Location and Access.—Four and a-half miles west of Kandanga; on portion 97, parish of Amamoor; ¼ mile north-west of Rendell's farm-house. Access

Open-cut, Upper Kandanga (M.L. 131) in base of steep-sided gully.

is by vehicle track through Rendell's property from the Happy Valley Road. The distance to Kandanga is 6 miles.

Geology and Workings.—Outcrops and floaters of massive jasper and jasperoid quartzite occur along the north-south ridge and manganese staining is widespread. Two small lenses of manganese ore have been found. A trench 10 ft. long, 4 ft. wide and 3 ft. deep has been opened up on the northern lens. The lens strikes N.40°E. and dips 45°N.W. A 2 ft. width of hard, massive, grey-black ore with coatings of soft black ore is exposed in the base of the trench, but the ore lens is too small to be of economic significance.

The ore in the southern lens is cellular and consists of a mixture of hard grey-black ore and soft black ore. Six tons of battery grade ore assaying 80·2 per cent. MnO_2 were produced in 1949. A trench 13 ft. long, 5 ft. wide and 6 ft. deep was opened up on this ore lens but it has apparently been worked out. About half a ton of ore is left on the dump. A fault which strikes north-south and dips 85°W. appears to have a structural control in the concentration of manganese oxides. Even though the known deposits are very small, the possibility of the discovery of further pockets of high grade battery ore gives some justification for additional exploratory work.

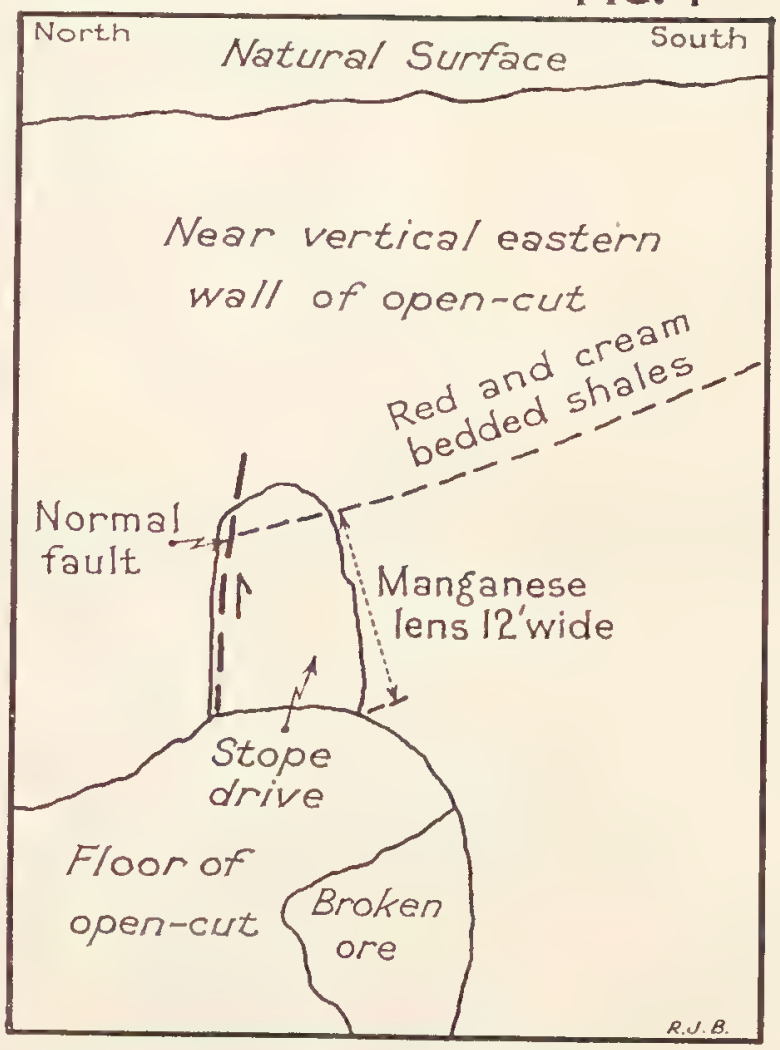
Arnold's Prospect (M.L. 257)

Lessees.—T. H. and M. A. Sanders.

Location and Access.—Four and a-half miles west of Kandanga; on portion 98, parish of Amamoor, ½ mile south of M.L. 256; in an old pineapple patch

View of eastern wall of open-cut, Upper Kandanga.

FIG. 4



Explanatory sketch, eastern wall of open-cut, Upper Kandanga.

adjacent to the boundary of Forest Reserve 435. Access is by vehicle track through Arnold's property from the Happy Valley Road. The distance to Kandanga by road is 6½ miles.

Geology.—Floaters of hard, massive blue-black ore occur in a soil-covered area 2 chains long and half-a-chain wide. The floaters of manganese ore are usually coated by soft black and brownish-black manganese oxides, and contain bands or irregular patches of chalcedonic silica and white clayey material. The surrounding rocks are red and cream silicified shales which are gently flexured. The shales strike north-north-east and dip west at 10° to 15°. A small intrusion of olivine dolerite occurs near the manganese prospect.

Although the prospects of finding a significant deposit of marketable ore are not particularly favourable, some bulldozing to determine the size and grade of the sub-surface material is warranted.

A sample submitted to the Geological Survey from portion 69, parish of Amamoor, 1 mile east of Arnold's Prospect assayed 47·2 per cent. Mn and 21·2 per cent. SiO_2.

Kandanga Town Prospect (M.L. 239)

Lessees.—T. H. and M. A. Sanders.

Location and Access.—Less than ½ mile S.S.E. of Kandanga township on subsection 2 of resubdivision 7 of subdivision 32, portion 1080, parish of Imbil. Access from Kandanga is by vehicle track through cultivated land.

Geology and Workings.—Floaters of manganese ore occur in a soil-covered area over a length of 100 yd. in a north-westerly direction. Two trenches have exposed hard, grey-black, siliceous manganese ore. The south-eastern trench is 20 ft. long, 4 ft. wide and 5 ft. deep and the north-western trench, about 150 ft. away, is 8 ft. long, 5 ft. wide and 3 ft. deep. Some bulldozing along the strike is warranted to define the extent and grade of the prospect, although on present evidence the ore is too siliceous to be marketed.

Upper Kandanga (M.L. 131)

Lessee.—W. J. O'Neill; worked under tribute by T. H. Sanders; referred to as the "Kandanga lode" by Dunstan (1918); previously M.L. 53, 75, 92; M.L. 214 and 225 are adjacent to M.L. 131.

Location and Access.—3 miles east-south-east of Kandanga township; on subdivision 2 of portion 35v, parish of Imbil; in the base of a steep-sided northerly-trending gully. Access is by vehicle track which leaves

FIG 3

UPPER KANDANGA, M.L.131, MANGANESE DEPOSIT
MARY VALLEY

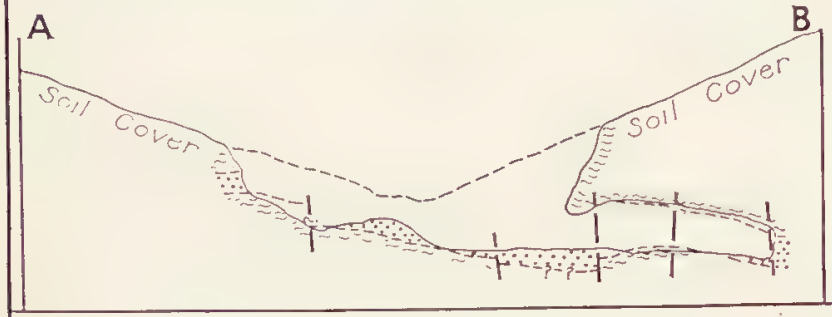
To accompany a report by J.H.Brooks B.Sc., Geologist
Plane Table survey by J.H.Brooks and L.G.Cuttler 24.6.60

SCALE OF FEET
80 40 0 80

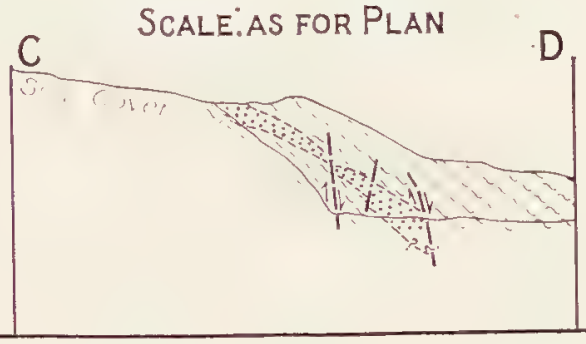
LEGEND

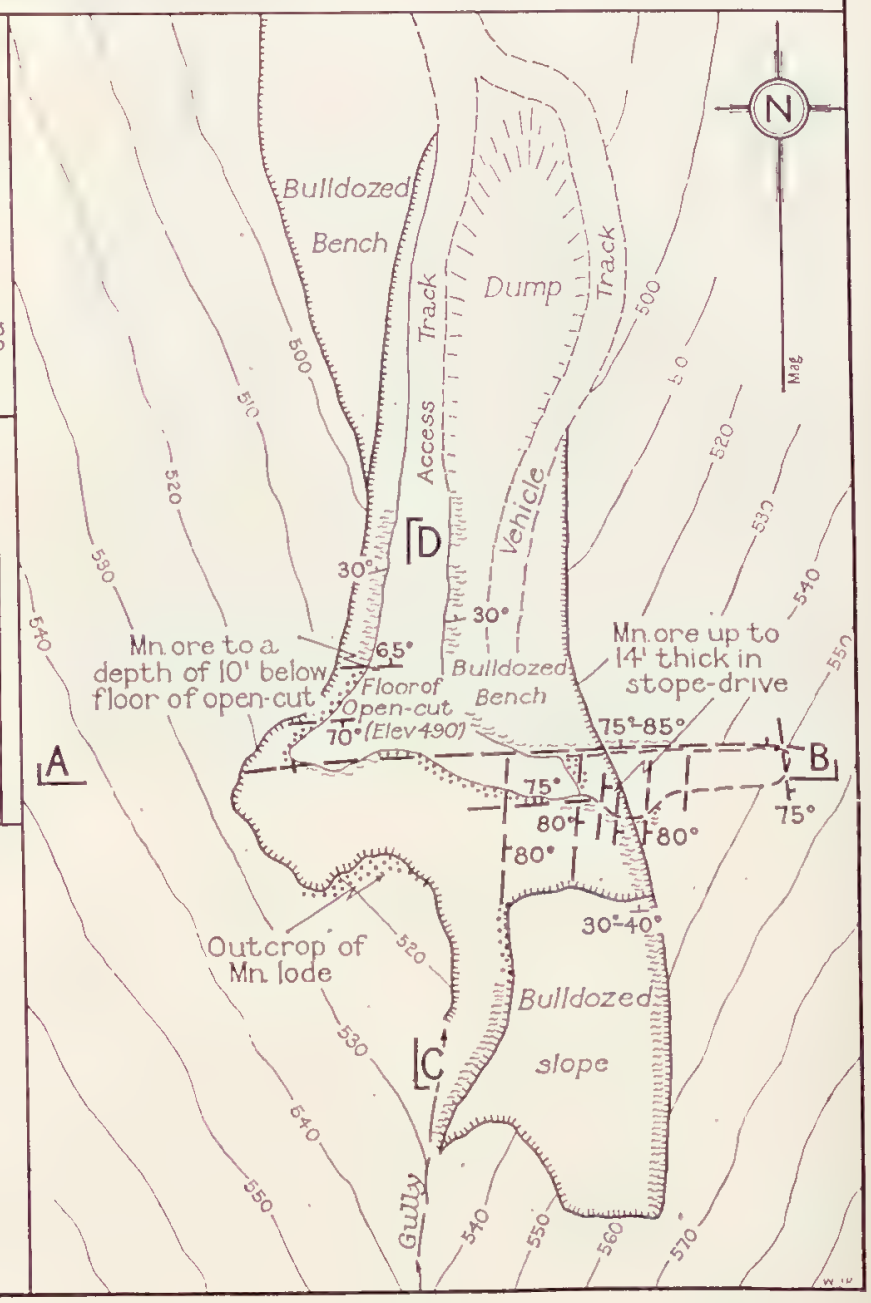
- Manganese lode
- Red and cream shales
- Vehicle track
- Top of open-cut or bank
- Waste dump
- 10' contour lines
- Outline of stope-drive
- Strike & dip of bedding
- Floor of open-cut
- Strike and dip of fault

LONGITUDINAL SECTION A-B
HORIZONTAL AND VERTICAL SCALE AS FOR PLAN



CROSS SECTION C-D
WITH WESTERN FACE OF OPEN-CUT PROJECTED ONTO LINE OF SECTION
SCALE AS FOR PLAN





the Upper Kandanga road ½ mile west of Stirling's saw-mill. The distance to Kandanga by road is 5 miles.

Geology and Workings.—The hard, massive, grey-black manganese ore (braunite) in this deposit is characterised by the presence of abundant disseminated grains of glassy quartz. Some fine veins of quartz and white clayey material are also present on some joint planes.

The manganese lens strikes N.80°W. and dips 35°N. It is interbedded with red and cream shales with narrow bands of quartzite and jasper. Faulting is of common occurrence in the manganese deposit, the two principal sets of faults being—(1) Strike faults which dip 65°N. to 70°S. and (2) Transverse faults which strike north-south to N.10°E. and dip 75°E. to vertical. Jointing is also well developed parallel to the fault directions. The intersection of the two sets of faults and joints results in rhomb-shaped blocks of ore and significant changes in grade often occur between adjacent blocks of ore. This is partly to be explained by the post-ore displacement and also by the influence of pre-ore faulting and jointing on the concentration of manganese oxides (see Cross-sections, figure 3). One important strike fault can be traced for the full length of the deposit and displaces the manganese lens north side down (see fig. 4). The down-faulted section of the deposit was first exposed

on the western side of the open-cut where the displacement amounts to only 2 or 3 ft. It has not been located on the eastern end of the open-cut where the displacement must be greater than 10 ft.

The deposit has been worked over a length of 145 ft. and a true width of up to 12 ft. Mining has extended down-dip for a distance of 70 ft. and the greatest vertical depth below surface of the base of the workings is 65 ft. Much of the manganese ore close to the outcrop was too siliceous to be marketed and other low grade blocks of ore occur particularly near the western ends of the open-cut and towards the hangingwall and footwall of the ore lens. The open-cut is 105 ft. long, up to 60 ft. wide and 35 ft. deep. Adjacent to the eastern end of the open-cut a "ball-room" stope 40 ft. long, up to 21 ft. wide and up to 15 ft. high has been mined.

Production and Future Prospects.—Nine hundred and eleven tons of ore were produced in the 1918-19 period and 1,394 tons averaging 46 per cent. Mn and 22 per cent. SiO_2 in 1958-60 period. Mining was in progress at the time of the 1960 inspection and about 1,000 tons of ore were stockpiled near Amamoor by the end of 1960 when mining was suspended.

The limits of the deposits are not known either along the strike or down-dip. Marketable grade ore is known to extend 7 ft. below the floor of the open-cut on the western side, and the down-faulted section of the deposit has not been traced across to the eastern side of the open-cut. Many hundreds of tons of ore may be proved to exist by further development of the deposit which is considered to be one of the best prospects for future production in the Mary Valley. A major hindrance to mining is that the open-cut is subject to flooding which restricts mining to periods of dry weather and necessitates the lowering of the approach cut as the ore lens is followed down-dip.

Roberts' Prospect (M.C. 4734)

Lessees.—C. P. and S. A. Roberts.

Location and Access.—5½ miles west-south-west of Kandanga; on portion 54, parish of Imbil; on Stirling's property, ½ mile south of the Upper Kandanga telephone office. Access from the Upper Kandanga Road is by vehicle track. The distance to Kandanga by road is 7½ miles.

Geology and Workings.—Pockets of manganese ore occur in three horizons of thick-bedded, jasperoid quartzite which strike N.10°E. to N.15°E. and dip 45°–50°W. The eastern and western horizons are 110 ft. and 75 ft. respectively from the middle horizon. The hard, dense, massive ore has a steely appearance and usually contains finely granular quartz. The reject ore contains patches of jasper and grey chalcedonic silica.

Eastern Horizon.—Three small pockets of manganese ore have been exposed in pits ranging from 3 ft. to 5 ft. deep. Jasperoid manganese ore is exposed in the base of the pits and a small amount of rhodonite is associated with the manganese oxides.

Middle Horizon.—A small open-cut 21 ft. long, 14 ft. wide and 10 ft. deep has been excavated. Metallurgical grade ore is exposed over an area 3 ft. in diameter in the base of the open-cut. The ratio of reject ore to marketable ore would approximate 4:1. An outcrop of massive, manganese-stained jasper extends for a distance of 150 ft. to the south of the open-cut. The jasper is fairly heavily quartz-veined. Evidence of the control of manganese concentration by jointing can be readily seen in this horizon.

Two pits, each 4 ft. deep, on the western horizon expose very inferior grade jasperoid manganese ore.

A sample of ore submitted by the lessees assayed 43·0 per cent. Mn and 25·2 per cent. SiO_2 but a sample representative of the 15 tons of ore at grass assayed 38·6 per cent. Mn and 32·9 per cent. SiO_2. Thus some regrading of the ore at grass will be necessary to obtain a parcel of marketable grade ore. In view of the high proportion of reject ore to marketable ore, it is unlikely that further development of the deposit could be profitably undertaken.

A sample of siliceous manganese ore from portion 73, parish of Amamoor, 1 mile north of Roberts' prospects, assayed 33·5 per cent. Mn and 35·6 per cent. SiO_2.

Thomas' Prospect (M.L. 248)

Lessee.—H. Coop.

Location and Access.—6 miles W.S.W. of Kandanga; on portion 49, parish of Imbil, on Thomas' farm, one mile S.S.W. of the Upper Kandanga telephone office. Access from the Upper Kandanga road is by a rough vehicle track through Thomas' property. The distance to Kandanga by road is 9 miles.

Geology.—Boulders and small outcrops of manganese ore occur over a distance of 60 ft. in a north-easterly direction. The hard, dense, massive, blue-black ore is encrusted by soft black manganese oxides. Veins of white quartz are present in some of the boulders. The manganese horizon is underlain by red silicified shales which strike N.55°E. to N.70°E. and dip 50°–60°S.E. On the access track silicified shale and quartzite interbedded with weathered andesite are exposed.

The deposit is virtually unexplored and some bulldozing is warranted to define its size and grade. However, the indications are that the deposit will prove to be small.

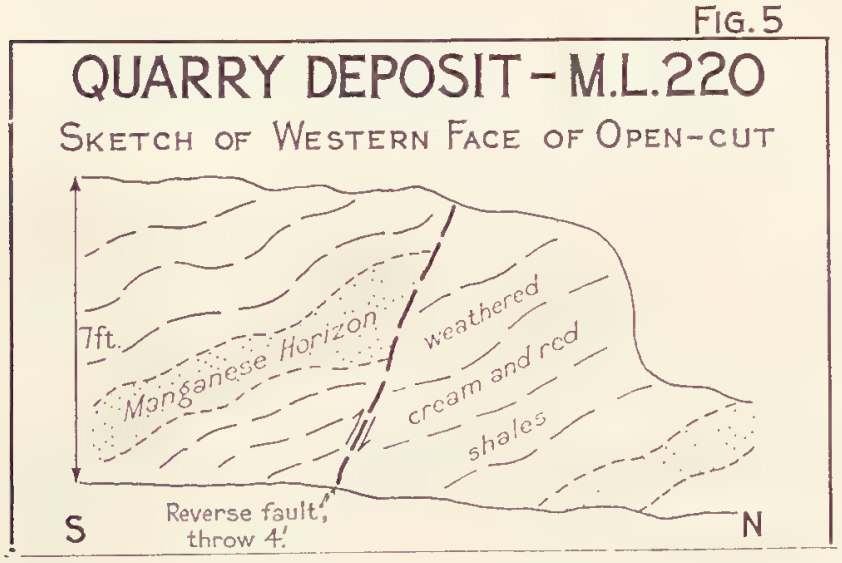
Reeve's Prospect (M.L. 222)

Lessees.—T. H. and M. A. Sanders.

Location and Access.—Two and a-half miles south-east of Kandanga; on resubdivision 1 of subdivision 8, portion 1673, parish of Imbil. Access is through McClintoch's property. The road to McClintoch's diverges east from the Kandanga-Imbil Road. The distance by road from Imbil is 5 miles.

Geology and Workings.—The ore is of the hard, dense, massive, blue-black type and usually has white quartz veins and patches of grey chalcedonic silica associated with it. The maximum exposed thickness of manganese ore is 3 ft. but for the most part the manganese ore occurs as thin bands and lenses interbedded with red silicified shales and quartzite. The strike of the bedding is N.80°E. and the dip is 20° to 30°S. Three bulldozer cuts have been excavated. The one parallel to the strike of the bedding is 65 ft. long, 12 ft. wide and 10 ft. deep. It did not expose

FIG. 5



any manganese ore. The two bulldozer cuts parallel to the dip of the beds are only a few feet deep and have exposed narrow bands and lenses of siliceous manganese ore. A sample taken by Mr. Reeves assayed 40·3 per cent. Mn and 24·3 per cent. SiO_2. The quantity of ore, even of this marginal grade, is quite small and no further exploratory work is warranted.

Quarry Deposit (M.L. 220)

Lessee.—T. H. Sanders; previously M.L. 152.

Location and Access.—Two and a-half miles north-east of Imbil; on subdivisions 7 and 10 of portion 737, parish of Brooloo; a few hundred yards north-west of Muir's farmhouse; a small abandoned road metal quarry is situated 150 ft. to the west. Access is from a short branch road from the Kandanga-Imbil Road, via Yabba Vale.

Geology and Workings.—The hard, massive, blue-black ore contains finely-disseminated, glassy quartz in addition to veins and irregular patches of quartz, jasper and red clay. The manganese lens is interbedded with cream and red shales which strike N.20°W. and dip 30°W.S.W. Gentle flexuring of the shales has taken place. The main manganese lens is up to 5 ft. wide and there are minor lenses of manganese ore in the overlying shale succession. A fault which strikes N.40°W. to N.10°W. and dips south-west at 65° to 75° displaces the main manganese lens (see Figure 5).

The open-cut is 70 ft. long, 46 ft. wide and 15 ft. deep. Siliceous manganese ore has been exposed in shallow trenches and pits for a chain north-northwest of the open-cut and floaters of manganese ore indicate the probable persistence of the manganese ore lens for 2 chains towards Muir's farmhouse.

Some mining activity took place in 1949 and again in 1958-59 but no production is recorded. Several tons of graded metallurgical ore is at grass but it is doubtful if this ore would assay more than 40 per cent. Mn. For assay data refer to Table 3.

Under more favourable economic conditions some further exploratory work would be warranted. The proximity of the farm buildings is a deterrent to the development of this deposit.

Muir's Prospect (M.L. 219)

Lessee.—T. H. Sanders.

Location and Access.—Two and a-half miles north-east of Imbil; on subdivision 7 of portion 737, parish of Brooloo; about a quarter of a mile south-west of Muir's house. Access is from the Kandanga-Imbil Road, via Yabba Vale.

Geology and Workings.—The ore is of the hard, massive, blue-black type and usually contains jasperoid material and quartz veins. The manganese ore lens is 23 ft. long and up to 7 ft. thick and is underlain by silicified shales. The strike of the lens is N.30°W. A bulldozer cut 50 ft. long and 16 ft. wide indicates that the deposit is superficial and there are no prospects for production.

New Bollier (M.Ls. 217, 218)

Lessee.—T. H. Sanders; previously M.L. 151 (McNabb's).

Location and Access.—2·2 miles north-east of Imbil; on subdivisions 8 and 10v, portion 737, parish of Brooloo. The deposits on these adjacent leases are approximately 100 yd. and 200 yd. west of the Imbil-Tuchekoi Road. The distance to Imbil by road is 3½ miles.

Geology and Workings.—1. *M.L.* 218 (western deposit). The ore is mainly of the hard, massive blue-black type with some cellular ore. A little finely granular quartz is present. No ore is visible in the base of the open-cut which is 45 ft. long, 32 ft. wide and 8 ft. deep. It is reported that the manganese ore lens pinched out in depth.

Near the north-eastern corner peg of the lease a bulldozer cut has exposed silicified red shales and jasper striking N.20°W. and dipping rather flatly to the west-south-west. Manganese is present as stains on the jasper bands. Twelve tons of ore were sent away in 1958 as battery grade but it did not assay the required 75 per cent. MnO_2. A few tons of metallurgical grade ore were also produced.

2. *M.L.* 217 (eastern deposit). Very little could be seen of this deposit at the time of inspection and most of the following information is taken from a

description by W. G. Burns (1951). Four small lenses of manganese ore were mined, the largest being 25 ft. long and up to 5 ft. wide. The ore ranges from the hard, cellular, blue-black type to the softer black and brownish-black type. Apart from a little white clay and iron oxides the ore is usually free of impurity. Assays of parcels of ore ranged from 78·8 per cent. to 80·2 per cent. MnO_2. The manganiferous horizon strikes north-north-west and dips 30°W. The country rocks, which consist of cream clay-shales with jasperoid quartzite bands, are gently flexured.

Sixty tons of battery grade ore were produced in 1950 from shallow open-cuts and trenches. It is reported that additional production has since taken place but no reliable information on this is available. In 1959, T. H. Sanders bulldozed two open-cuts. The southern open-cut is 65 ft. long, 15 ft. wide and 10 ft. deep. Water obscured the base of the open-cut at the time of inspection but Sanders reported that manganese ore was exposed over a width of one foot in the base. The northern open-cut is 50 ft. long, 28 ft. wide and 10 ft. deep and is one chain distant from the southern open-cut. The amount of ore which could be economically mined from this deposit is small.

Lowe's Prospects (M.Ls. 223, 224)

Lessee.—T. H. Sanders.

Location and Access.—Three miles north-east of Imbil; on portion 1635F, parish of Brooloo. Four small deposits are distributed over a distance of a quarter of a mile. The northernmost deposit is only about 200 ft. south of Coonoon Gibber Creek. Access is from the Imbil-Bollier Road (Lowe's Road) by a rough vehicle track. The distance by road to Imbil is 6½ miles.

Geology and Workings.—1. Northern prospect. Two occurrences of manganese about 2 chains apart have been explored by bulldozing to a depth of 3 ft. Hard, blue-black botryoidal ore occurs mainly as encrustations up to ½ inch thick on bedding and joint planes. In addition there are a few narrow lenticular horizons of very siliceous manganese ore in red jasperoid shales which strike N.50°W. and dip 45° to 60°S. The amount of marketable ore in this prospect is negligible.

2. Central prospect. Manganese occurrences on either side of a gully have been prospected by bulldozing. The bulldozer cut on the western side of the gully is 8 ft. deep and exposes two horizons of manganese ore up to 2 ft. thick associated with brown jasperoid beds. The beds strike N.10°E. and dip 45°E. and are overlain by cream and red shales.

A lens of siliceous manganese ore up to 2 ft. in thickness is exposed in the bulldozer cut 7 ft. deep on the eastern side of the gully. The ore contains jasperoid material and quartz veins, and is interbedded with gently-flexured, brown and red jasperoid rocks. The strike of the bedding is N.50°W. and the dip 45°S.W.

3. Southern prospect. A bulldozer cut 6 ft. deep has exposed a lens of manganese ore 10 ft. long and 2 ft. thick in gently flexured jasperoid beds. Manganese staining persists at the same horizon for the full 45 ft. length of the bulldozer cut. A little metallurgical grade ore could be graded from the exposed lens but the prospects of economic development are poor.

Open-cut, Old Bollier (M.L. 213). Floor of open-cut obscured by water

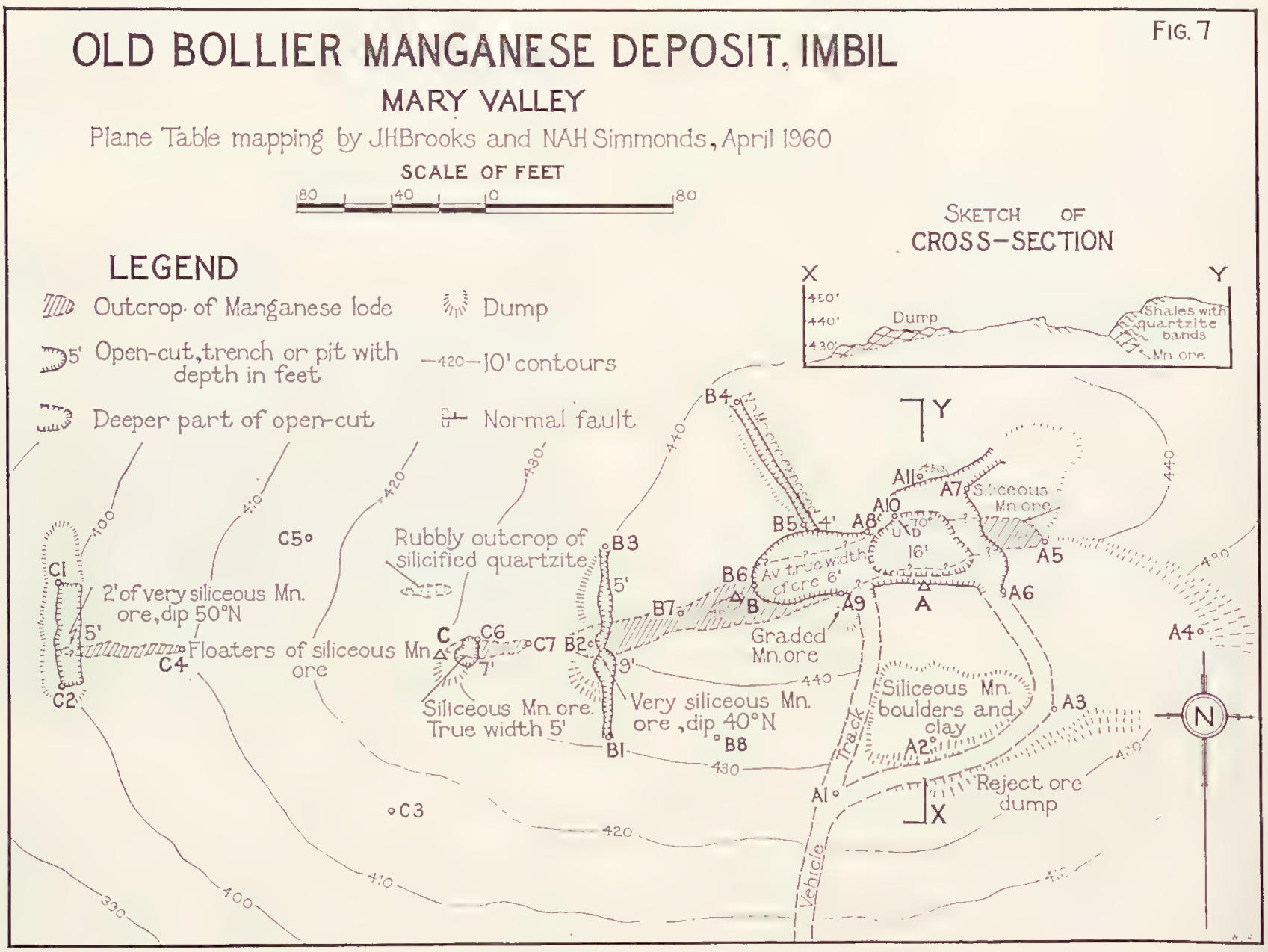
The diversity of strike and dip readings recorded from the six bulldozer cuts is suggestive of a high degree of structural deformation in the area. None of the manganese lenses exposed gives promise of containing a significant amount of marketable ore, but under more favourable economic conditions the northern and southern prospects would warrant further exploration.

Old Bollier (M.L. 213)

Lessee.—J. G. Craig; previously held as M.L. 54, 91, 100 and 141 (Bollier).

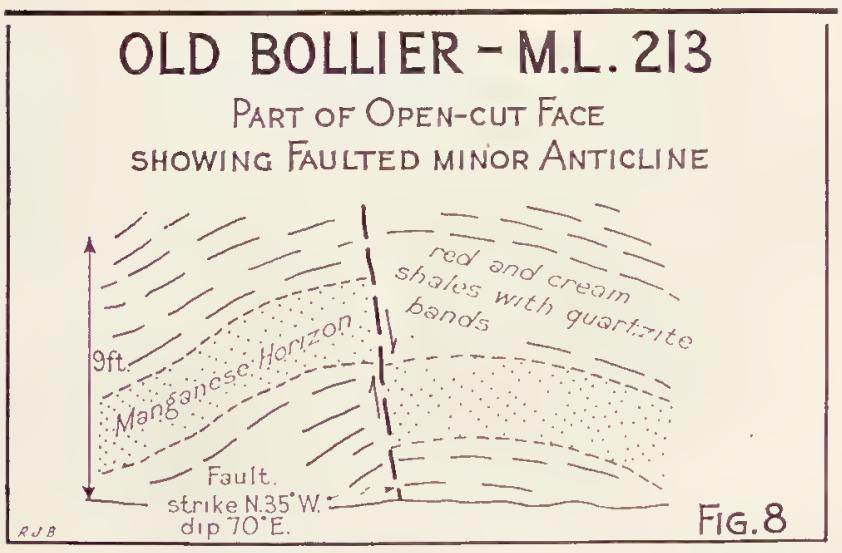
Location and Access.—3·3 miles N.N.E. of Imbil on portion 80V, parish of Brooloo. The deposit is a few hundred yards north of the Imbil-Bollier Road (Lowe's Road), the distance to Imbil by road being 4½ miles.

Geology and Workings.—A horizon of manganese ore striking east-west to east-north-east and dipping north at 40° is interbedded with red and cream shales and bands of jasperoid quartzite. Minor folding of the succession is evident in the open-cut and the grade of ore in the synclinal areas is appreciably higher than that in the anticlinal areas. Minor post-ore faulting has taken place. (See Figure 8.) The ore is of the hard, massive, grey-black type and disseminated quartz is the principal impurity. The manganese horizon is exposed discontinuously over a length of 425 ft. (See Figure 7.) The true width in the open-cut area is 6 ft. and the width decreases to 2 ft. in the westernmost exposure.



The main open-cut is 100 ft. long, 40 ft. wide and 16 ft. deep. Other workings consist of three trenches and a pit.

Production of metallurgical grade ore has amounted to 573 tons. One hundred and fifty-seven tons were produced in 1918-19 and 416 tons in 1958-59. Even with careful hand-sorting of the ore it has been difficult to maintain the grade above the minimum requirement of 40 per cent. Mn.



The amount of +40 per cent. Mn ore in sight is quite small but the deposit contains substantial reserves of lower grade ore. It is estimated to contain 160 tons per vertical foot of ore assaying about 30 per cent. Mn. As the deposit is located near the crest of a hill and dips at 40°, it could probably be open-cut to a depth of 50 ft. Further development of the deposit appears to be largely dependent on the possibility of utilisation of lower grade, siliceous ore.

Imbil Rail-Cut Prospect

Location and Access.—Subdivision 3 of portion 23v, parish of Imbil, adjacent to the railway line, ½ mile N.N.W. of Imbil.

Geology.—A lens of hard, massive, blue-black siliceous ore occurs in a succession of red shales and jasper. The bedding strikes north-north-west and dips westerly at 30°. Boulders of manganese ore extend for a distance of 25 ft. south of the railway cutting where the manganese lens is exposed over a width of up to 8 ft. Samples of ore averaged 39·7 per cent. Mn, 28·6 per cent. SiO_2 and 0.4 per cent. Fe_2O_3.

The deposit is small and of marginal grade, and it is doubtful if a lease application over it would be granted in view of its proximity to the railway and road.

Imbil West (M.L. 159)

Lessees.—M. C. and G. A. Campbell; worked on tribute by T. H. Sanders.

Location and Access.—1·6 miles W.N.W. of Imbil; portion 26v and subdivision 2 of portion 28v, parish of Imbil; on a steep easterly trending spur above a pineapple plantation. Access is through "Mountain View" property, the distance to Imbil by road being 2½ miles. There is an increase in elevation of over 500 ft. from Imbil to the lease.

History of Development.—This deposit is of particular interest because it has been inspected at various stages of development. Burns inspected the deposit in 1950 when the only workings consisted of a few shallow trenches. The ore near the surface was siliceous for the most part and Burns reported unfavourably on the prospects for further development. The next inspection (Brooks, 1956) took place after a small open-cut had been excavated to reveal a lens of marketable grade metallurgical ore 40 ft. long and up to 8 ft. wide. Over 400 tons of ore had been produced from the open-cut up to that time. In view of the experience with other manganese deposits in the district up to that time, it was expected that the ore lens would not persist below a depth of 30 ft. and reserves were estimated at 300 tons of probable ore with an additional few hundred tons of possible ore. Subsequent inspections were made by Wyatt (1957) and Brooks (1959 and 1960). About 2,000 tons of ore were produced between 1956 and 1960. Marketable manganese ore persisted to a vertical depth of over 60 ft. and over a strike length of approximately 150 ft. The 4 to 8 ft. width of marketable grade ore on the footwall of the manganiferous zone proved remarkably persistent and some additional ore was recovered by careful hand-picking of lenses of more siliceous ore overlying the footwall ore. The footwall ore lens has been worked down-dip a distance of 75 ft. Although siliceous near the surface, it improves in grade with depth, but at about 75 ft. down-dip from the surface it decreases in width to 1½ ft. and appears to be pinching out in the deepest exposures.

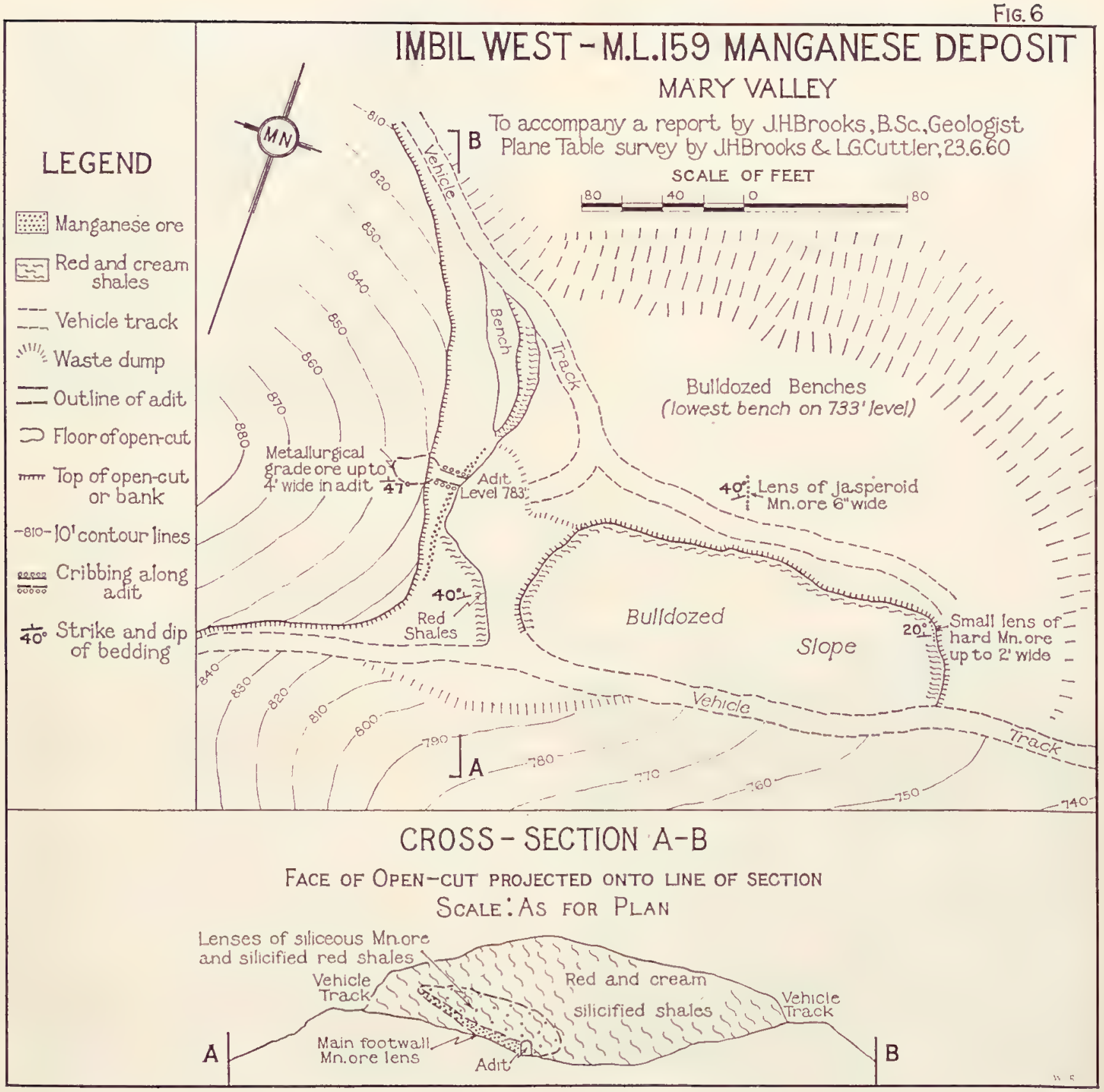
Open-cut, Imbil No. 2 (M.L. 244). Shows lenticular nature of manganese deposit

Open-cut, Imbil West (M.L. 159). Timber at base of open-cut face is protecting the entrance to the exploratory adit. Maximum height of open-cut face 60 ft.

Throughout the development of the deposit difficulty has been experienced in grading the ore. Assays of ore produced in the 1954-59 period ranged from a maximum of 50·8 per cent. Mn and 7·5 per cent. SiO_2 to 28·6 per cent. Mn and 47·5 per cent. SiO_2 and averaged 44 per cent. Mn and 22 per cent. SiO_2. At times purchases of ore by Broken Hill Proprietary Co. Ltd. were suspended because of deliveries of low-grade, siliceous ore.

Geology and Workings.—The ore is of the hard, massive, blue-black type (braunite, cryptomelane) with disseminated fine grains of glassy quartz. One small lens of soft, black ore was exposed during open-cut mining operations but no battery grade ore has been produced. Quartz veins and jasperoid inclusions are fairly common particularly towards the top of the manganiferous zone. This zone is up to 30 ft. thick and is overlain and underlain by red and cream shales which have been silicified adjacent to the manganiferous zone. The strike of the bedding is N.65°E. and the dip 35°-50°N.W.

FIG. 6



In the present open-cut face the footwall lens of ore appeared to be pinching out along the strike but an adit placed into the open-cut face showed that the lens bulges again to a width of over 4 ft. The adit has been extended 35 ft. and marketable ore is still showing in the face.

Production and Future Prospects.—A total of 2,598 tons of ore has been produced from this deposit which ranks with the *Amamoor* and *Upper Kandanga* deposits as the most important in the Mary Valley. Probably several hundred tons of marketable ore remain in the deposit but the open-cut face is now 60 ft. high and further open-cut mining will be limited by the rapid increase of the overburden to ore ratio.

Imbil No. 2 (M.L. 244)

Lessees.—G. A. Campbell and T. H. Sanders.

Location and Access.—One and a-half miles west-north-west of Imbil, 300 yd. south of *Imbil West* M.L. 159, on subdivision 2 of portion 28v, parish of Imbil. Access is similar to that for *Imbil West*. The deposit is in cleared lantana scrub on the side of a rather steep gully.

Geology and Workings.—A lens of hard, dense, massive blue-black, manganese ore (braunite, cryptomelane) occurs within a succession of red, silicified shales and quartzite. The manganese lens strikes N.30°E, dips 30° N.W. and has been exposed for a length of over 100 ft. and a width of 6 ft. It pinches

out at the southern end of the open-cut but the northern end has not been exposed. The overall grade of the manganese lens is estimated to be between 30 per cent. and 35 per cent. Mn and probably not much more than a quarter of the manganese ore in the face could be selected by hand-sorting to produce ore with a grade exceeding 40 per cent. Mn. Impurities in the ore are irregularly disseminated grey chalcedonic silica and some white clayey material. The silica content tends to be higher towards the base of the manganese lens.

The shales overlying the manganese lens have been stripped off for 15 ft. to 20 ft. back from the working face. The present ratio of overburden to manganese ore is 1:1 and overburden is no immediate problem to the further development of the deposit. A trial parcel of 18·3 tons of ore assayed 44·0 per cent. Mn, 22·3 per cent. SiO_2 and 1·4 per cent. Fe. *Imbil No.* 2 could be one of the more important deposits with respect to potential production, particularly if lower grade ore becomes marketable or beneficiation is possible.

Branch Gully (M.L. 241)

Lessees.—B. K. O'Leary and T. H. Sanders; previously M.L. 146 (Butler's Corner).

Location and Access.—Four and a-quarter miles west of Imbil on Forest Reserve 256, parish of Imbil. The deposits are near the base of a steep hill-slope just inside a Hoop Pine plantation. Access is by the Branch logging area track from the Yabba Creek Road. The distance to Imbil by road is 5½ miles.

Geology and Workings.—Two small lenses of manganese ore occur in a succession of red, silicified shales and quartzite striking N.15°W. and dipping 43° west. On a nearby hill-slope quartzite with interbedded shale and jasper strikes N.15°E. and dips 10° to 40°W. Crenulation of the beds is pronounced. The manganese lenses consist of a mixture of hard, massive, blue-black ore and soft black ore.

The upper manganese lens was mined over a length of 30 ft. and a width of 3 ft. and yielded about 20 tons of metallurgical grade ore assaying 44·7 per cent. Mn and 21·5 per cent. SiO_2. A similar quantity of reject siliceous ore is stacked nearby. The ore lens pinched out at a shallow depth and no further development is warranted.

The lower manganese lens is exposed over a length of 35 ft. and a maximum width of 2 ft. Several tons of metallurgical and battery grade ore were produced but the lens is too narrow to be developed to any greater depth. Further development would also involve damage to Hoop Pine trees and compensation would be payable to the Forestry Department. Selected samples of hard and soft ore assayed 56 per cent. and 79 per cent. MnO_2 respectively. However, a parcel of 3·1 tons of battery ore assayed only 67·2 per cent. MnO_2.

Branch Gully No. 2 (M.L. 235)

Lessee.—J. G. Craig.

Location and Access.—Four and a-half miles west of Imbil in firebreak compt. 1, Branch logging area, Forest Reserve 256, parish of Imbil. It is elevated about 400 ft. higher than *Branch Gully M.L.* 243 and ¼ mile to the west. Access can be obtained to within 5 chains of the prospect by a Forestry Department track through a Hoop Pine plantation. Between the pine plantation and the prospect the steep hill-slope is heavily timbered.

Geology.—Small outcrops and boulders of hard, massive, blue-black manganese ore with coatings of soft black manganese oxides occur over a length of 70 ft. The manganese horizon is overlain by massive jasper and jasperoid quartzite which appear to strike east-west. Most of the manganese ore exposed is of fair to good quality metallurgical grade and the deposit warrants bulldozing to define the extent of the deposit. Manganese boulders are reported to have been found in a gully a few hundred yards west of M.L. 235 and this occurrence may also warrant exploration by bulldozing.

Cream and reddish silicified shales are exposed in road cuttings along the access track. The shales are commonly manganese-stained and are strongly faulted. They strike N.15°E. and dip 30°W. Incipient cleavage is developed with fine-grained sericite on cleavage planes. The principal direction of faulting is north-west but dip angles are diverse. Some floaters of micro-diorite were observed between the access track and the lease.

Borg's Prospect (M.L. 136 (forfeited))

Location and Access.—Five miles west-south-west of Imbil, on portion 7, parish of Imbil, in cleared dairying land 200 yd. north of the Yabba Creek Road. The distance to Imbil by road is 6 miles.

Geology and Workings.—Several small lenses of manganese ore have been exposed in a series of shallow open-cuts and trenches over a length of 200 ft. The largest open-cut is 30 ft. long, 10 ft. wide and 6 ft. deep. The manganese lens and interbedded red shale and jasper range in strike from N.10°E. to N.10°W. and dip 70°–80° west. Some soft black ore is present but the hard, massive, grey-black type predominates. Most of the hard ore is siliceous and often has small amounts of rhodonite associated with it.

Twenty tons of ore produced in 1949 averaged 49·5 per cent. Mn, 8·0 per cent. SiO_2, 1·5 per cent. Fe and 0·043 per cent. P. A selected sample of soft ore assayed 75 per cent. MnO_2. The lenses of manganese ore appear to be too small to warrant development to any greater depth. No attempt at further production has been made in recent years.

Yabba Creek Ford (M.L. 130 (forfeited))

A small lens of manganese ore is located on a north-west trending jasper ridge in the north-west corner of Forest Reserve 135, parish of Brooloo, 5½ miles west-south-west of Imbil, downstream from

the Borumba dam. A few tons of high-grade ore were extracted but the deposit is too small to warrant further development.

Dwyer's Lease (M.L. 216)

Lessee.—O. W. Dwyer.

Location and Access.—Seven miles south-west of Imbil on Forest Reserve 467, parish of Yabba, one mile south-west of Borumba dam site. The lease area is overgrown by lantana. The access track diverges west from the Yabba Creek Road just upstream from the Borumba dam site, but alternative access will be required when the Borumba dam is constructed.

Geology and Workings.—The hard, massive grey-black manganese ore contains quartz veins, clay and a little jasperoid material. Boulders of manganese ore are usually encrusted by soft black manganese oxides but internally they are often very siliceous. The country rocks are finely-banded, lavender-grey phyllites with some quartzite bands.

Bulldozer cuts have exposed manganese ore discontinuously over a length of 50 ft. and to a maximum depth of 10 ft. The width of manganese ore has not been defined. Twenty tons of metallurgical grade ore were produced in 1959 but little marketable grade ore is in sight and the prospects of further production are not very favourable. A selected sample taken by the lessee assayed 47·9 per cent. Mn, 47·1 per cent. MnO_2 and 12·5 per cent. SiO_2.

Soanes' Prospect (M.L. 233)

This prospect leased to G. H. and L. B. Soanes is situated 7 miles south-west of Imbil, on Forest Reserve 467, parish of Yabba, a few hundred yards south of M.L. 216 on the higher slopes of a steep hill. The lease was overgrown by lantana and an inspection was not practicable.

Mr. Soanes stated that boulders of high-grade, blue-black, metallurgical ore had been found. A little bulldozing was carried out on the lower slopes of the hill but this did not expose any manganese ore in situ. Some further bulldozing higher up the hill slope is warranted.

Craig's Lease (M.L. 230)

Lessee.—J. G. Craig.

Location and Access.—Eight miles south-west of Imbil, 2 miles upstream from the Borumba dam site, in Forest Reserve 467, parish of Yabba. The lease is adjacent to the Yabba Creek Road and will be partly submerged when the Borumba dam is filled.

Geology and Workings.—The ore is of the dense, massive, blue-black type with a smooth, conchoidal fracture. Subordinate amounts of crystalline, blue-black ore, and soft black ore are also present. The manganese lenses are enclosed by phyllites which strike N.20°E. and dip west at 80°. White, vein quartz and minor amounts of disseminated glassy quartz and rhodonite occur as impurities in the manganese ore.

About 200 ft. north of the road, manganese ore is exposed over a length of 40 ft. and a maximum width of 2 ft. in two small pits and a bulldozer cut. Samples of ore were stated to have assayed over 50 per cent. Mn and 78 per cent. MnO_2. Although the grade is high, the manganese lens is hardly big enough to repay development under present conditions.

Several boulders of fair to good grade metallurgical ore occur adjacent to the Yabba Creek road but no ore was seen in situ. A bulldozer cut midway between the road and the pits failed to expose any manganese ore.

Yabba Creek (M.L. 158)

Lessee.—W. J. O'Neill; previously worked by Young and Campbell as the "Lucky Star" M.L. 128.

Location and Access.—Seven and a half miles south-west of Imbil, 1¾ miles south-west of the Borumba dam site, in Forest Reserve 135, parish of Brooloo. The vehicle track to the lease diverges south from the Yabba Creek Road 10 miles from Imbil.

The deposit was not inspected because no significant developments have taken place since it was described by W. G. Burns (1951) and the lease area and access track were overgrown by lantana. In addition, the deposit will be inundated when the Borumba dam is filled.

Geology and Workings.—Hard, massive, blue-black ore with some associated jasper and red clay occurs in a succession of slate, red and cream shale, chert and massive and cleaved mudstone. The ore occurs as "blocks" which appear to be terminated by faults. The strike of the bedding is north-north-west and the dip 60°W. to vertical. Most of the ore was produced from the southern open-cut which is 66 ft. long, 16 ft. wide and 12 ft. deep. The northern open-cut is 55 ft. long and 14 ft. wide. Nine hundred and fifty-three tons of ore averaging 52 per cent. Mn and 12 per cent. SiO_2 were produced in 1949-50. Only siliceous remnants of the developed manganese lenses remain. Some bulldozing to remove overburden adjacent to the open-cut was carried out in 1957 but no manganese ore was exposed.

Mt. Walli (M.L. 124)

Lessee.—W. J. O'Neill; worked on tribute by T. H. Sanders. Also known as "The Charles" and "Mt. Ubi" M.L. 89, 93. J. G. Craig took up two leases, M.L. 215 and 226, adjacent to M.L. 124.

Location and Access.—Two and a half miles south of Kenilworth, on Sims' property, portion 212, parish of Maleny, on a lower slope of Mt. Walli. Access is from the Kenilworth-Obi Obi Road by the Walli Creek Road. Eumundi, the most convenient railhead, is 23 miles from Mt. Walli.

Geology and Workings.—No mining has taken place since the deposit was described by S. R. L. Shepherd (1939). Hard, blue-black, crystalline and mas-

sive ore with minor amounts of soft, black ore occur in the deposit. Nearly all the ore now exposed in the open-cut is siliceous and a recent trial parcel of hand-sorted ore assayed only 40 per cent. Mn. The impurities consist of irregular patches of cream chalcedonic silica, rhodonite, clay and jasper. The manganese lens ranges up to 11 ft. in thickness and is exposed in two open-cuts over a total length of 150 ft. It is sub-horizontal and is overlain in the main open-cut by a similar thickness of quartzite. Transverse faults at the ends of the main open-cut strike N.20°E. and N.30°E. and dip vertically. The downthrow is on the west and the vertical displacement is 3 ft. to 5 ft.

Production and Future Prospects.—In 1937-38 approximately 700 tons of ore were produced for shipment to Germany. In 1938 parcels of ore railed to Brisbane were not sold because no market could be found for the ore. The only production since that time has been the recent trial parcel of 20 tons. *Mount Walli* is considered to have prospects for the future production of substantial amounts of ore, but the grade and transport costs will be critical factors if further development of the deposit is considered.

An occurrence of manganese is reported on portion 96v, parish of Maleny, in the Chinaman Creek valley, 2 miles south-south-east of the *Mt. Walli* mine. No information on the size or grade of the occurrence is available.

Mt. Walli No. 2 (M.L. 259)

Lessee.—H. Coop.

Location and Access.—Two and a half miles south-south-east of Kenilworth on Forest Reserve 918, parish of Maleny, on a steep south-eastern upper slope of Mt. Walli (1,575 ft.). Access is through Sims' Property (see Mt. Walli M.L. 124) by a steep track negotiable only by four wheel drive vehicles. The difference in elevation between the access road and the lease is over 1,100 ft.

Geology and Workings.—A lens of hard, blue-black crystalline and massive manganese ore with some soft black ore is exposed in a bulldozer cut over a length of 100 ft. and width of up to 6 ft. The manganese lens is overlain by quartzite and jasper and underlain by weathered (?) andesite. Impurities in the ore are granular quartz, irregular patches of jasperoid material and a little rhodonite. The bedding strikes N.25°W. and dips south-westerly. Faults which strike N.20°E. and dip 80°W. to vertical displace the manganese horizon slightly. Very little of the ore exposed is of marketable grade and in view of the very difficult access, further development of the deposit does not appear warranted.

Mt. Allan (M.Ls. 104, 109, 150)

Lessees.—F. R. R. Fielding; F. Rodgers and A. J. Campbell. Sub-leased to J. G. Craig and worked under tribute by T. H. Sanders. Previously known as the "Black Hawk".

Open-cut, Mt. Allan. Fire watch-tower on crest of Mt. Allan in background.

Location and Access.—Six and a-half miles south-west of Kenilworth, in Forest Reserve 274, parish of Cambroon, on the northern side of the crest of Mt. Allan (2,075 ft.). Access is from the Kenilworth-Jimna forestry road by a track to the fire tower on the crest of Mt. Allan. The track is steep and is negotiable only in periods of fine weather. The distance to Eumundi, the most convenient railhead, is 33 miles.

Geology and Workings.—The *Mt. Allan* deposit has been described by T. H. Connah (1950). Since 1959 nearly all the ore remaining in the deposit has been removed by open-cut mining which has incorporated all the earlier workings. The main manganese ore lens narrowed sharply at a depth of 35 ft.

The ore consists mainly of the soft black type (pyrolusite) with subordinate amounts of hard massive ore and botryoidal ore (cryptomelane). Chalcedonic silica, white clay and rhodonite are the main impurities. The manganese lens is overlain by red and cream shales and is underlain by massive quartzite. The strike of the bedding is N.35°W. and the dip 35° to 60° south-west. Faulting has had an important influence on the supergene concentration of manganese oxides. The main ore lens was almond-shaped with the higher grade ore in the centre. A second, smaller lens of manganese ore was found underlying the main lens and separated from it by up to 10 ft. of country rock. The manganiferous horizon is exposed in the open-cut over a length of 145 ft. and a width of up to 6 ft. and it can be traced for about 125 ft. south of the main open-cut over a width of a few inches.

Production was intermittent between 1943 and 1959. Some 267 tons of metallurgical grade ore, about 350 tons of battery grade ore and a few hundred tons of chemical grade ore have been produced. It has been the largest producer of battery grade ore in the Mary Valley.

Passlow's Prospect (M.L. 246)

This prospect which is leased by R. V. Passlow is 7 miles south-west of Kenilworth, in Forest Reserve

274, parish of Cambroon, 0·3 miles south-west of Mt. Allan. The lease is adjacent to the access track to Mt. Allan and one mile from the Mt. Allan turn-off on the Kenilworth-Jimna road.

Manganese oxides occur mainly as stains and encrustations on cream and grey chalcedonic silica although a few small pockets of hard, lustrous, massive ore have been exposed by bulldozer cuts. White quartz veins are abundant. The country rocks are phyllites which strike N.65°W. and dip vertically. The deposit is of little economic significance and no further exploration is warranted.

Blunt Pick Prospect

This prospect is situated in Forest Reserve 274, parish of Cambroon, adjacent to a timber track on the western side of the Kenilworth-Jimna Road, 1 mile west of Mt. Allan. A bulldozer cut has exposed a lens of hard, grey-black, siliceous manganese ore 30 ft. long and 8 ft. wide. Some rhodonite and jasper is associated with the manganese oxides and the country rock is clay shale. No marketable grade ore is in sight and prospects for development are poor.

Adam's Prospect

Narrow bands of manganese ore were exposed in the timber track about ½ a mile from the *Blunt Pick* prospect, and were further explored by a small bulldozed open-cut. The ore consists of mixed hard and soft black oxides and occurs in a succession of purple, brown and cream shales which strike north-westerly and dip 80° north-east. The exposed bands of manganese ore are too narrow for economic development but some further exploration is warranted.

Summer Creek Prospect

Location and Access.—One mile north-west of Mt. Allan, in Forest Reserve 274, parish of Cambroon, on a tributary creek ¼ mile above its confluence with Summer Creek and upstream from the Summer Creek falls. Vehicle access is by a timber track from the Kenilworth-Jimna road to within one mile of the prospect. The remaining mile to the prospect is down a steep hillside into the Summer Creek valley.

Geology.—This prospect was not inspected and the following information is taken from a report by A. G. Macandie (1959). Boulders of manganese ore are distributed over a length of 150 ft. along a line of outcrops of quartzite and interbedded shales which strike N.20°W. to north and dip 60° to 70° west. The manganese occurs as pockets of siliceous hard ore with coatings of soft black manganese oxides. Quartz and rhodonite veins are present. Mr. Macandie considered the prospects for economic development are rather unfavourable.

Grigor's Prospect

Location.—Four and a-half miles west of Conondale, on Forest Reserve 591 near portion 185v, parish of Conondale, on a ridge at the head of Scrubby Creek. Access is by a timber track from the Scrubby Creek sawmill near the main Conondale-Kenilworth Road. The distance to Conondale by road is 8 miles.

Geology.—A lens of manganese ore is exposed in a road cutting over a length of 20 ft. and a maximum width of 4 ft. The ore is mainly of the soft, black (pyrolusite) type with some pockets of hard crystalline ore. Some narrow quartz veins are present. Manganese staining is fairly widespread in the phyllites enclosing the manganese lens. The phyllites strike N.35°E. and dip 65°S.E. Granodiorite crops out along the access track from the sawmill and a contact with phyllite and quartzite is exposed in a road cutting near the top of the ascent from Scrubby Creek to the top of the range.

The ore in this prospect is mainly of battery grade but the exposed lens probably contains no more than a few tons of marketable ore. Mr. Grigor stated that other occurrences of manganese have been found in the ranges between the prospect inspected and Mt. Allan to the north. On surface indications the occurrences were considered too small or too low grade to warrant development.

L. C. Ball (1945) reported manganese on portion 1128, parish of Conondale. He referred to it as "McGregor's prospect" on his locality map but he did not inspect the locality. He also has a manganese locality marked near Scrub Creek on Forest Reserve 322, approximately 3 miles south of Conondale. Possibly small tonnages of battery grade ore could be found in the Conondale area and in view of the demand for this class of ore the prospects for exploration are encouraging.

REFERENCES

Annual Reports.—Under-Secretary for Mines, Queensland.

Ball, L. C., 1904.—Certain iron ore, manganese ore and limestone deposits in the Central and Southern Districts of Queensland. *Geol. Surv. Qld Publ.*, 194.

————, 1945.—Mount Allan manganese workings. *Qld Govt Min. J.*, 46, p. 46.

Brooks, J. H., 1956.—Imbil West, M.L. 159, manganese deposit, Mary Valley. *Ibid*, 57, pp. 763-765.

————, 1959.—Manganese mining in the Mary Valley, 1959. (Unpublished report to Chief Government Geologist.)

Burns, W. G., 1951.—The nature and origin of the manganese ores of the Mary Valley, Queensland. (Unpublished honours thesis, University of Qld.)

————, 1961.—Geology of the Mary Valley manganese belt, South-Eastern Queensland. *Qld Govt Min. J.*, 62, pp. 234-238.

Casey, J. N., 1956.—Manganese in Australia in SYMPOSIUM SOBRE YACIMIENTOS DE MANGANESO. 20th International Geological Congress, Mexico.

Connah, T. H., 1949.—Manganese, Yabba Creek, Imbil. (Unpublished report to Chief Government Geologist.)

————, 1950.—Manganese workings, Mt. Allan. *Qld Govt Min. J.*, 51, pp. 326-328.

Denmead, A. K., 1928.—A survey of the Brisbane Schists. *Proc. Roy. Soc. Qld*, 39, pp. 71-106.

————, 1944.—Manganese lode, Kilkivan. *Qld Govt Min. J.*, 45, p. 98.

DIMMICK, T. D., 1954.—The "H.Q." manganese occurrence, Amamoor district, Mary Valley. (Unpublished report to Chief Government Geologist.)

DUNSTAN, B., 1909.—Manganese near Gympie. *Ann. Rep. Qld Dep. Min.* for 1908, p. 169.

————, 1918.—Manganese at Kandanga. *Qld Govt Min. J.*, 19, p. 558.

FLEISCHER, M., and RICHMOND, E. W., 1943.—The manganese oxide minerals, a preliminary report. *Econ. Geol.*, 38, pp. 269-286.

FLEISCHER, M., 1960.—Studies of manganese oxide minerals. III. Psilomelane. *Amer. Mineralogist*, 45, pp. 176-187.

HALL, L R.., and GRIFFIN, R. J., 1959.—Manganese deposits of the Walcha district. *N.S.W. Dep. Min. Technical Reports*, 4, 1956, pp. 65-72.

HEWITT, D. F., and FLEISCHER, M., 1960.—Deposits of the manganese oxides. *Econ. Geol.*, 55, pp. 1-55.

MACANDIE, A. G., 1958.—Manganese ore deposits, Mary Valley, Queensland. (Unpublished report to Broken Hill Proprietary Co. Ltd.)

————, 1959.—Manganese ore deposits, Mary Valley, Queensland. (Unpublished report to Broken Hill Proprietary Co. Ltd.)

MCANDREW, J., and EDWARDS, A. B., 1954.—Manganese ores from New South Wales and Queensland. *Sci. Ind. Res. Org. Aust. Mineragr. Rep.* 578.

MORTON, C. C., 1929.—Amamoor manganese deposit. *Qld Govt Min. J.*, 30, pp. 326-328.

REED, J. J., 1960.—Manganese ore in New Zealand. *New Zealand J. Geol. Geophys.*, 3, pp. 344-354.

RIDGWAY, J. E., 1934.—Booloumba, Peter and Bundaroo area, Kenilworth district. *Qld Govt Min. J.*, 35, pp. 261-263.

RIDLEY, W. F., 1960.—The Maryborough basin. In THE GEOLOGY OF QUEENSLAND. (*J.*) *Geol. Soc. Aust.*, 7, pp. 297-301.

SHEPHERD, S. R. L., 1938.—Manganese deposits, Mary Valley district. (Unpublished report to Chief Government Geologist.)

————, 1939.—Notes on manganese deposits (Mary Valley district). *Qld Govt Min. J.*, 40, p. 117.

WYATT, D. H., 1957.—Imbil West, M.L. 159, manganese deposit, Mary Valley. (Unpublished report to Chief Government Geologist.)

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Yabba Creek (M.L. 158)	28
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Zachariah Creek (M.L. 162)	15

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 309

COAL RESOURCES, ROSEWOOD-WALLOON COALFIELD

Smithfield No. 3 Mine Area
Rosemount No. 4 Mine Area
Oakleigh Mine Area—Supplement

By J. B. CAMERON, B.Sc.App. (Geol.), Geologist

Lanefield No. 5 Mine Area—Extension

By E. S. CHIU CHONG, B.Sc., Geologist

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COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(SMITHFIELD No. 3 MINE AREA)

By J. B. Cameron

SUMMARY

This report sets out the results of exploratory diamond drilling carried out ahead of workings early in 1957. Five holes, totalling 1,635 ft. 1 in. were drilled.

The group of seams tested occurs in a coaly sequence some 50 ft. thick lying near the top of the Walloon Coal Measures. Workable sections were intersected in three seams.

Seam sections were sampled to allow for possible alternative methods of beneficiation, but, because of the installation of a washing plant, reserves were calculated to suit this method only. Sampling results have been compared with plant performance.

Drilling established measured reserves amounting to 330,000 tons over an area of 40 acres in the Bottom seam now being worked. Westerly, the upper section of this seam deteriorates, but a working section is available by combining the two lower plies with the Lower seam, which here lies close beneath. Measured reserves in the Lower seam based on this working section amount to 120,000 tons, but if an alternative reduced thickness is worked, they would be approximately 85,000 tons.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

The most southerly producing pits in the Rosewood Coalfield are situated about 1½ miles to the south of Rosewood. Exploratory diamond drilling by the Mines Department was first undertaken in this area early in 1957, when from February to May five boreholes, N.S. 84-88, were drilled by the Sullivan 22 H.D. plant in the Smithfield No. 3 mine area. Aggregate footage was 1,635 ft. 1 in., overall core recovery being 95·9 per cent.

Because of uncertainty at the time as to what methods of coal beneficiation would be adopted at Smithfield No. 3 Colliery, the sampling of workable coal sections penetrated during the drilling programme was designed to assess as accurately as possible the quality of the product that could be marketed after the usual selective underground mining followed by:—(i.) handpicking of stone on the surface or (ii.) washing. This was achieved by excluding from samples analysed all shale bands which normally would be removed underground and by washing, and then determining the ash content and specific gravity of those shale bands in the discard which would not be removed on the picking belt. In estimating coal resources, however, only coal cleaned by method (ii.) above has been considered as a small McNally-Goodwin jig-type washing plant was installed at Smithfield No. 3 Colliery late in 1958.

Accompanying the report are the following plans, sections, and diagrams:—

(*a*) Locality Map—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and areas within which reserves have been estimated—fig. 2.

(*c*) Generalised Bore Sections—fig. 3.

(*d*) Diagrams of seams showing sections analysed and results—

Top seam—fig. 4.
Bottom and Lower seams—figs. 5 and 6.

(*e*) Generalised Correlation Diagram of Bottom and Lower seams—fig. 7.

(*f*) Cross-section—fig. 8.

MINE WORKINGS

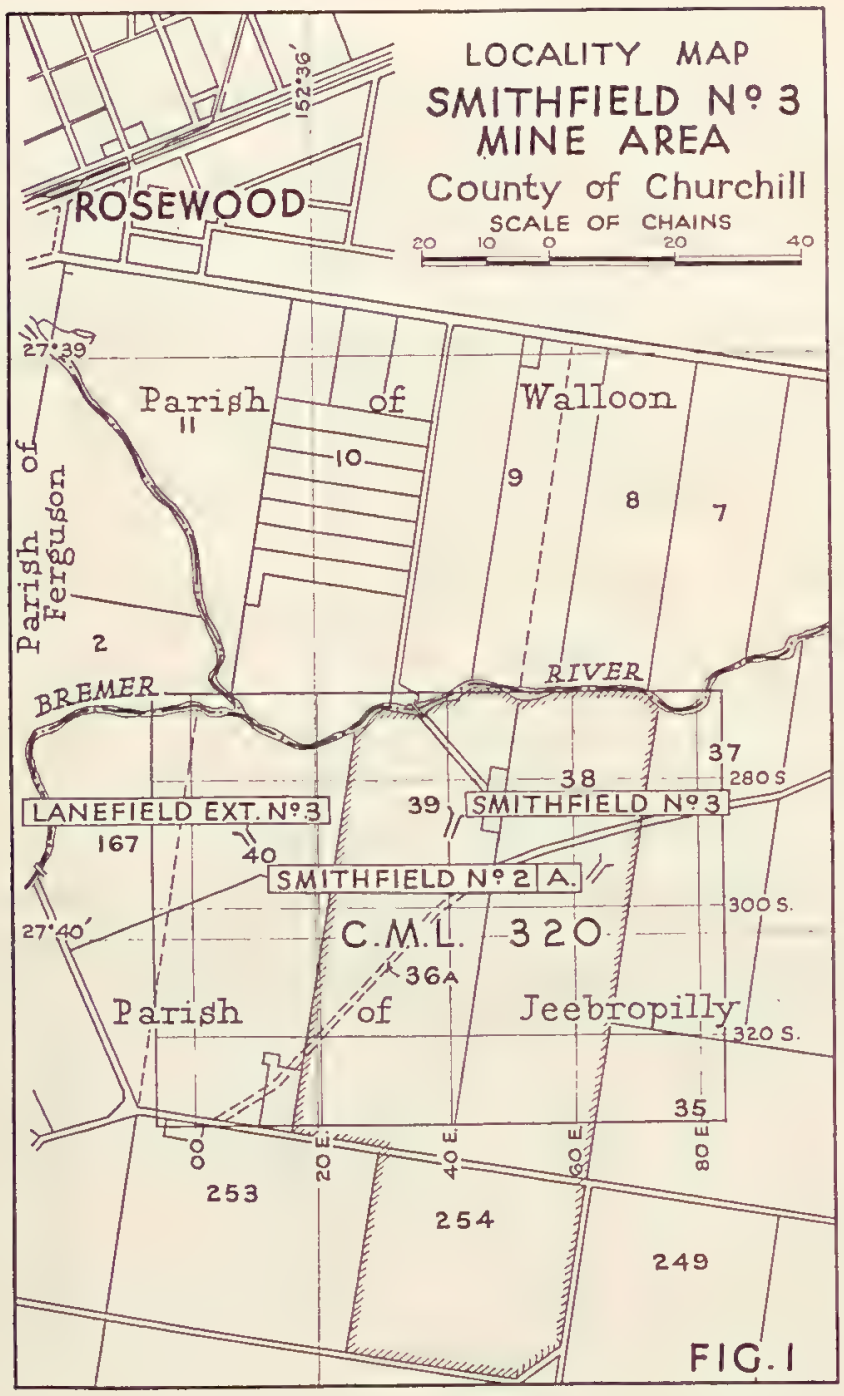
Smithfield No. 3 Colliery is situated 1½ miles south-south-east of Rosewood Railway Station. The workings lie within Coal Mining Lease No. 320 held by Smithfield Collieries Pty. Ltd. Operations first commenced in this mine area in 1943 at Smithfield No. 2 Colliery. The Bottom seam was worked there but colliery development to the dip was restricted by the thickening of a grey shale band within the working section to over 4 ft. In 1952, Smithfield No. 3 tunnel was driven from about ¼ mile to the west, the No. 2 workings being abandoned in the following year. Although the Top seam was worked for a short period in 1953-4, most of the coal won from Smithfield No. 3 Colliery has come from the Bottom seam.

The only other producing pit in this part of the coalfield is Lanefield Extended No. 3 Colliery, situated less than a quarter of a mile to the west. The seams worked there lie approximately on the same stratigraphic horizons as those in Smithfield No. 3 Colliery.

GENERAL GEOLOGY

The coalbearing strata of the Smithfield No. 3 mine area belong to the Walloon Coal Measures of Jurassic age and, although separated from the rocks of the type area by the wide alluvial valley of the Bremer River, are known, as a result of surface mapping, to occur near the top of that formation. The seams so far exploited in this southern district of the coalfield constitute a coaly sequence at least

50 ft. thick. This group of seams can be correlated with a similar productive sequence which occupies the same stratigraphic position in the Perry's Knob area some 3 miles to the north. The group there was first termed the Rosewood seams by Reid (1922) and recently was described more fully by Cameron (1959).



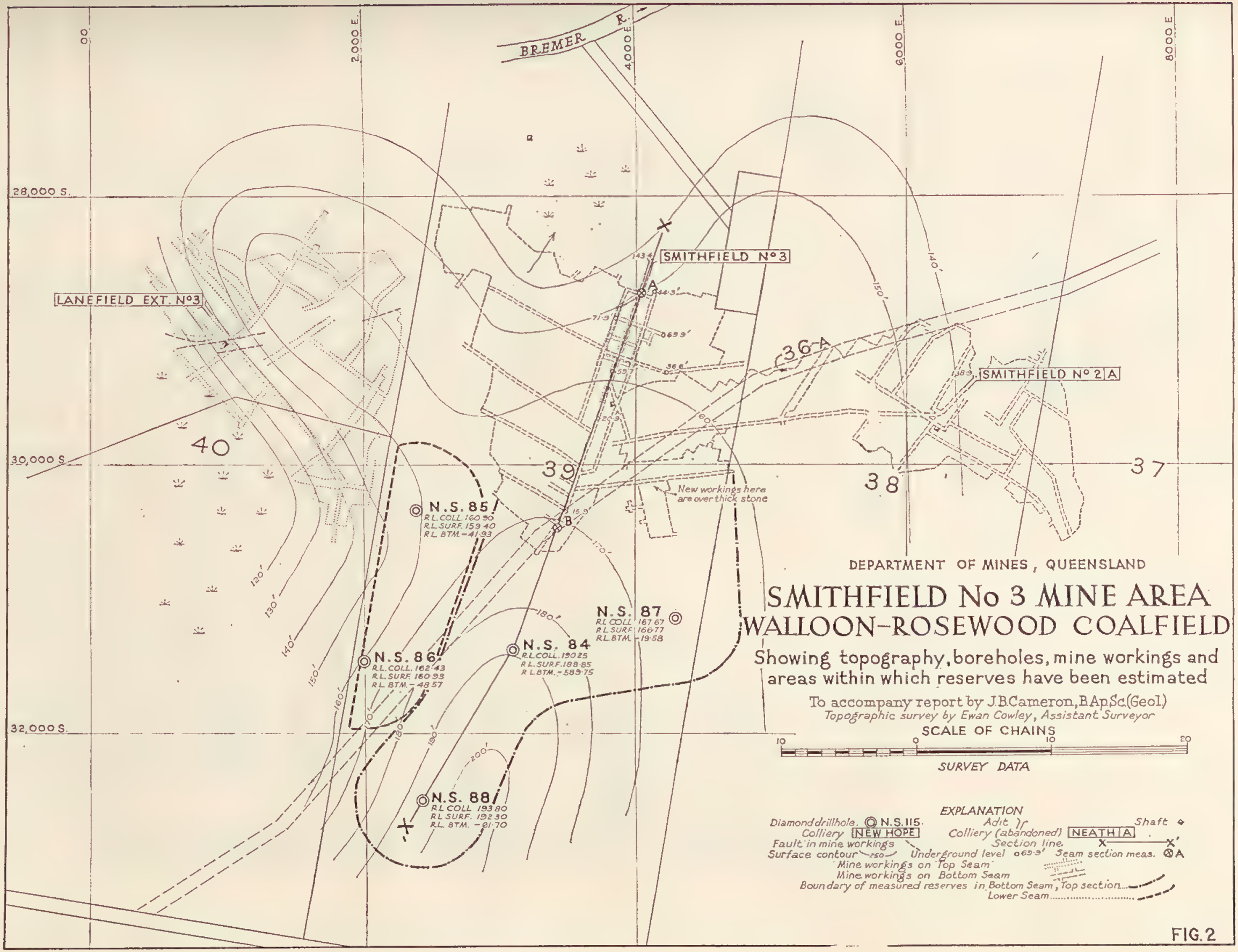
SUBSURFACE GEOLOGY

The highest coal seam in the succession in the Smithfield area is that encountered in borehole N.S. 84 at a depth of 34 ft. 8 in. This seam, 2-3 ft. thick, lies approximately 125 ft. above the seams so far worked, the intervening strata being interbedded argillaceous and calcareous fine sandstone. Because of its restricted section and limited extent, the seam is not of commercial interest.

The **Top seam** as worked at Smithfield No. 3 Colliery was 6 ft. 6 in. thick, including several shale bands totalling almost 18 inches (see fig. 4). Immediately above and below the worked section were another 2 ft. and 1 ft. 3 in., respectively, of shale and coal bands; overall seam thickness was therefore nearly 10 ft. Such thick coaly sections were not penetrated in any of the diamond drill holes. In boreholes N.S. 84, N.S. 86, and N.S. 88, the reduction in the working section is due to the splitting off of the bottom 2 ft. of the seam by 4-7 ft. of light grey shale and siltstone. The seam is similarly split in borehole N.S. 85 by at least 4 ft. of shale; the upper part of the seam, however, was not cored in this hole. In borehole N.S. 87, the seam, although unsplit, is just over 4 ft. thick and has a sandstone roof, the top coal having apparently been removed by contemporaneous erosion.

The interval between the Top seam and the **Bottom seam** ranges from 11 ft. (N.S. 84) to 43 ft. (N.S. 85), the strata being grey shale and siltstone with some beds of fine sandstone. As exposed in the early workings of Smithfield No. 3 Colliery, the section of the Bottom seam is usually 5-6 ft. thick. Immediately above this there is another 3 ft. of interbedded coal and shale with 6-12 in. of characteristic, grey-white, waxy shale near the top; below, at intervals of 6 in. to 2 ft. 6 in., there is another 9 in. of coal. Within the worked section there are two persistent shale bands—4 in. of fawn shale about 2 ft. from the roof, and 1-5 in. of grey shale 1 ft. 8 in. to 1 ft. 10 in. from the floor. To the south, the lower grey shale band increases rapidly in thickness. When drilling commenced at Smithfield early in 1957, dip development had been suspended owing to the growth of this band to over 3 ft. Thickening of this same shale band occurred also in the workings from Smithfield No. 2 tunnel and was mainly responsible for the abandonment of the colliery. Within the area tested by the drilling, the splitting of the Bottom seam is even more pronounced; in boreholes N.S. 84 and N.S. 87 there is as much as 8 ft. of stone between the top and bottom coal sections. Fortunately, in the vicinity of boreholes N.S. 84 and N.S. 87-88, a working height of 6 ft. can be maintained in the Bottom seam by mining approximately 2 ft. of coal with thin shale bands previously left in the roof (see figs. 5, 6, and 7). This is not possible, however, to the west around boreholes N.S. 85-86 because of deterioration of the coal above the persistent fawn shale band.

The existence of another seam of coal below the Bottom seam at Smithfield was known prior to the commencement of drilling. As encountered in the Smithfield No. 3 colliery airshaft, the **Lower seam** was 3 ft. 3 in. thick, occurring about 6 ft. below the Bottom seam. This interval decreases rapidly to the west, for, in a shaft 13 chains to the north-west of the No. 3 tunnel entrance, the seam is reported to lie only 1 ft. 6 in. below the Bottom seam and to be 4 ft. thick. Likewise in boreholes N.S. 85-86, the seam is separated from the split-off lower coal of the Bottom seam by only 7 in. of shale, the combined coal plies here constituting a workable section 7-8 ft. thick (see figs 6 and 7). The Lower seam was penetrated also in boreholes N.S. 84 and N.S. 88 but only in the western part of the mine area is it of economic interest.



DEPARTMENT OF MINES, QUEENSLAND

SMITHFIELD No 3 MINE AREA WALLOON–ROSEWOOD COALFIELD

Showing topography, boreholes, mine workings and areas within which reserves have been estimated

To accompany report by J.B.Cameron, B.Ap.Sc.(Geol)

Topographic survey by Ewan Cowley, Assistant Surveyor

SCALE OF CHAINS

10 0 10 20

SURVEY DATA

EXPLANATION

Diamond drillhole. ◎ N.S.115 — *Adit* — *Shaft*

Colliery NEW HOPE — *Colliery (abandoned)* NEATH A — *Section line* X—X'

Fault in mine workings

Surface contour 150 — *Underground level* 069·9' — *Seam section meas.* ⊗A

Mine workings on Top Seam

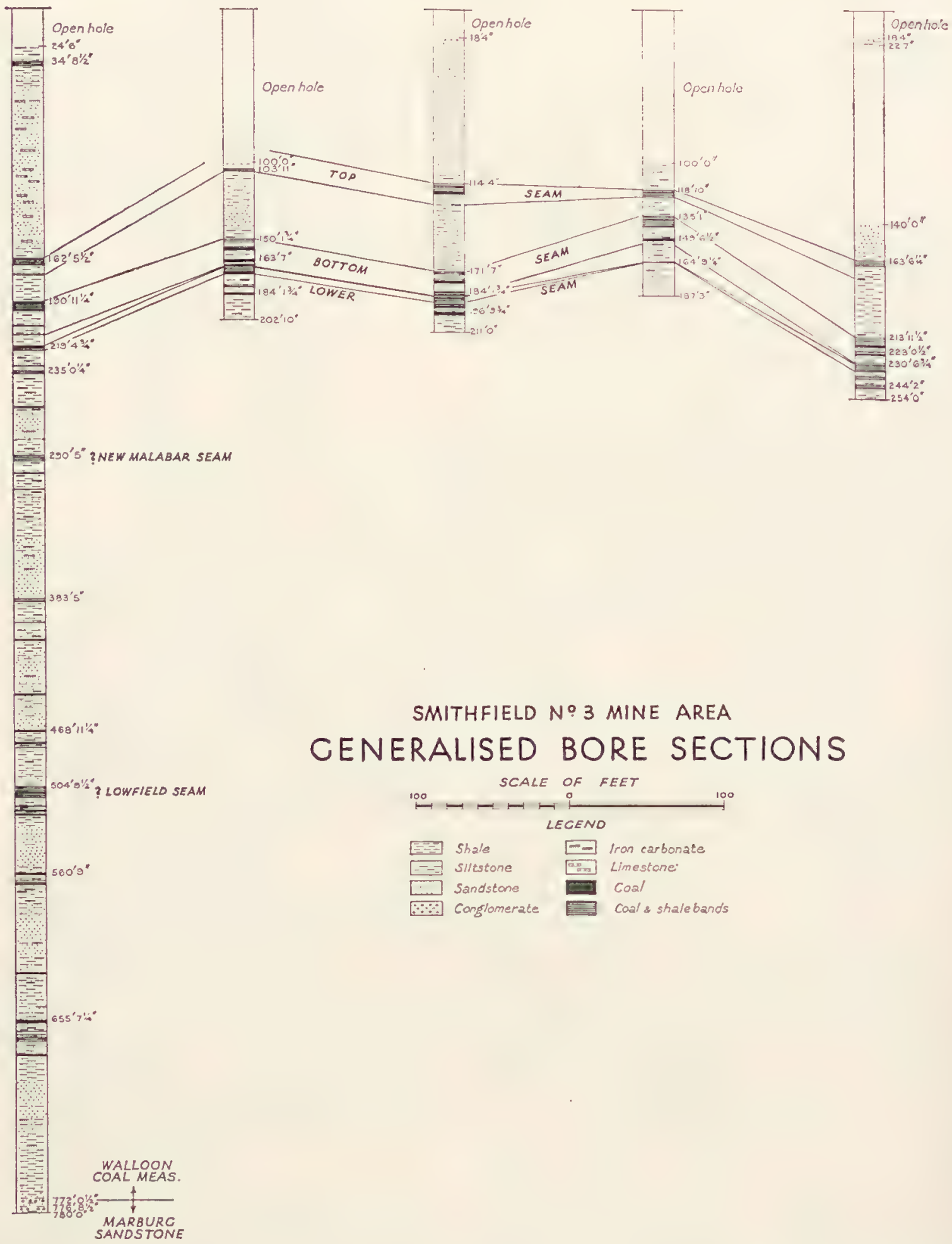
Mine workings on Bottom Seam

Boundary of measured reserves in Bottom Seam, Top section

Lower Seam

FIG. 2

FIG. 3



SMITHFIELD Nº 3 MINE AREA

GENERALISED BORE SECTIONS

SCALE OF FEET

100 0 100

LEGEND

Shale	Iron carbonate
Siltstone	Limestone
Sandstone	Coal
Conglomerate	Coal & shale bands

SMITHFIELD No.3

FIG. 4

DIAGRAMS OF TOP SEAM — DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 84

Prox.Analysis S.,Cal.value,SG. | Recovery percent | Section Sampled | Seam Section | Description

M% 5·8
VM% 36·6
FC% 37·4
A% 20·2
Joules/gm. 24,990
BTU/lb. 10,750
S% 0·51
SG 1·41

91·5% 283/57

2¾" sh excl in 4 bands marked +: A% 62·3
8¼" sh excl. in 2 bands marked +: A% 73·7

Excl+ / Excl+ / Excl+ / Excl+ / Excl+

Roof: f.sa.; 1½" d.gy.sh.; 4'1" carb.sh.; 2'4" inf.coal; 6" d.gy.sa. — carb.sh.; 162'5½" 2" carb.sh.; 2" coal; 3¾" inf. coal, 2¾" d.gy.sh.; 5" coal w. few fn.sh.lam.; ½" m.gy.sh.; 3" coal; 4" carb.sh.; 1' (part.bkn) coal; 4¾" l.gy.sh.; 10" (bkn) coal; ¾" fn.sh.; ¼" carb.sh.; 9¼" coal; ½" fn.sh.; 7⅜" coal; 167'10¼"; 4'2" l.gy.sh.; ½" carb.sh., 1" coal, 1½" d.gy.sh.; 2½" wh.sh.; ¾" carb.sh.; 2'4" coal, 2" m.gy.sh.; ½" (t) coal, ½" d.gy.sh., 6½" coal; 1" carb.sh.; 2" coal, ¾" carb.sh.; 2¼" d.gy.sh.; 1¾" coal; 179'1" Floor: sh.

Overall recovery 96·1%

N.S. 88

Prox.Analysis S.,Cal.value,SG. | Recovery percent | Section Sampled | Seam Section | Description

M% 6·7
VM% 33·2
FC% 32·4
A% 27·7
Joules/gm 21,760
BTU/lb. 9,360
S% 0·65
S.G. 1·50

90·8% 486/57

3¼" sh. excl. in 2 bands marked +: A% 72·7

Excl+ / Excl / Excl+

163'6¼" Roof: l.gy.sh. & sa. interbd.; 5½" coal w. ¼" fn.sh. at ¾"; ½" tpd fn. & carb.sh.; & fn.sh.; 2½" coal, ¾" carb.sh.; ¾" coal; 2½" carb.sh.; 5" coal; 4" carb.sh.; 6+" d.gy.sh. w. ¾" (b) coal at 5½"; 2¼" carb.sh.; 6" (pb) coal; 4 (pb) d.gy.sh.; 167'7½" 2" (pb) coal & two ½" lenses l.gy.sh at 1½" as; 5'0½" l.gy.sh. w. l.gy.slts. & l.gy.f.sa. lam. fr. 1'10" — 3'3"; 1" carb.sh.; 1" coal; 2½" wh.sh.; 1½" carb.sh.; ½" l.gy.sh.; 10¼" carb.sh.; 2" coal; 1¾" l.gy.waxy sh.; 175'5¾" 3" coal; Floor: l.gy.slts.

Overall recovery 92·7%

MINE WORKINGS 'A'

Seam Section | Description

Section worked 6'6"

Roof: sa.; 2½" coal; 8½" l.gy.sh.; ½" carb.sh.; 1" l.gy.sh.; 1" carb.sh.; 1½" inf. coal; 4" l.gy.sh.; 1" inf. coal; 2" d.gy.sh. w. coal lents.; 10" coal w. num. carb.sh. bands.; 1" d.gy.sh.; 3" inf. coal, ½" d.gy.sh.; 1" coal, ¾" d.gy.sh.; 3½" coal; 2" fn.sh.; 11" coal; 3' l-m.gy.sh.; 2" d.gy.sh.; 1" carb.sh. w. coal lents.; 3" coal; ¼" carb.sh. w. coal lents.; 8" coal; 2½" fn.sh.; 5½" coal w. two ½" bds. of carb.sh. at 2½" & 3½"; 1" carb.sh.; 4" coal; 3" m.gy.sh.; 1" coal; 2½" fn.sh.; 5" coal; ½" d.fn.sh.; 3" coal; 1½" fn.sh.; 2½" coal, ½" fn.sh.; 2½" coal; 8" fn.sh.; 1" coal; 2½" fn.sh.; 2" coal; Floor: l.gy.sh.

N.S. 87

Prox.Analysis S,Cal value,SG | Recovery percent | Section Sampled | Seam Section | Description

M% 7·2
VM% 34·5
FC% 35·1
A% 23·2
Joules/gm 23,220
BTU/lb. 9,990
S% 0·39
S.G. 1·44

85·3% 485/57

6¼" sh. excl. in 4 bands marked +: A% 75·2

Excl+ / Excl / Excl+ / Excl+

118'10" Roof: l.gy.f.sa.; 1¼" coal; 2½" l.fn.sh.; 11½" (p.bkn) coal w. two ¼" carb.sh. bands at 1¼" & 5"; 3½" l.gy.sh.; ½" coal; ½" carb.sh.; 3" l.fn.sh.; ¼" carb.sh.; 7½" (p.bkn) coal; ¾" carb.sh.; 2½" (p.t) coal, 2" l.fn.sh.; ½" coal; ½" l.fn.sh.; 1½" (bkn) coal, ¾" l.fn.sh.; ¾" carb.sh.; 122'8" Floor: l.gy.sh.

Overall recovery 85·0%

N.S. 86

Prox.Analysis S, Cal.value, S.G. | Recovery percent | Section Sampled | Seam Section | Description

A% 36·5
S.G. 1·87

2" excl. sh. bands: A% 72·1

M% 5·7
V.M% 37·4
F.C% 36·1
A% 18·8
Joules/gm. 25,560
B.T.U./lb. 11,000
S% 0·61
S.G. 1·40

2¼" excl. sh. band: A% 75·7

100% 494/57

86·7% 484/57

Excl / Excl. / Excl.

114'4" Roof: d.gy.sh.; 1⅝" inf. coal; 2¼" carb.sh. — inf. coal in pl.; 2'4" coal; ¾" br.sh.; 4½" inf. coal; 1⅛" fn.sh.; 4¾" carb.sh. w. ½" c at 1" & ¼" br.sh. at 3½"; ⅛" br.sh.; ¾" carb.sh.; 4½" coal; 3" carb.sh. — br.sh. in mid 1"; 1" coal; 3½" carb.sh. w. lens of d.gy.sh. at 1½"; 2" coal, 1" carb.sh.; 3" coal; 117'3¾" 117'7½" 3¾" carb.sh. w. tiny nod. of iron carb.; 10½" (p.bkn) coal; 2' gy.wh.sh.; ½" carb.sh.; 1'7½" (p.bkn) coal; 120'5" 1" d.gy.sh.; Floor: 1'6" d.l.gy.slts & sh.

Overall recovery 97·0%

FIG. 5

SMITHFIELD No. 3

DIAGRAMS OF BOTTOM & LOWER SEAMS — CORE RECOVERY AND ANALYSIS

N.S. 84

Prox. Analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
M 5·5 VM 37·1 FC 35·0 A 22·4 Joules/gm. 24,310 B.T.U./lb. 10,460 S 0·52 S.G. 1·42 2" sh. excl. in 4 bands: 192'7¾"–192'11" A 67·2	100%	284/57	189'11" Roof: l.gy.sh; 4½" coal; 1" carb.sh; 5" l.gy.fn.sh; 1¾" dk.gy.–carb.sh.;
		Excl.	190'11¼" 3¼" coal; ½" carb.sh;
		Excl.	5¼" coal; ½" gy.gy.–carb.sh.; ½" coal; ¼" fn.sh.; 2¼" coal;
		Excl.	¾" dk.gy.sh;
			192'7¼" 1" coal;
			192'11" 1" carb.sh w.num.coal lmts; 1¾" br.sh; 2" inf.coal (p.b); 1¼" coal (bkn)
		Excl.	2¼" br.arg.si.waxy sh; ¾" carb.sh;
			7" coal (p.bkn)
		Excl.	2" m.gy.sh.; 2¼" carb.sh;
			4¾" coal & inf.coal (bkn);
89·2%	285/57	Excl.	½" carb.sh; 3½" fn.waxy sh.;
			1½" coal (p.b); ¾" carb.sh;
		Excl.	1½" coal (bkn); 1¼" dk.gy.–carb.sh.;
			1'1" (bkn) coal;
			196'11½" 2" dk.gy–carb.sh.;
			1'8½" l.gy.sh;
			198'10" NOT TO SCALE 5'8" lt.gy.slts;
			204'6" 6½" l.gy.sh;
			205'3" 1½" dk.gy.sh; 1" carb.sh; 2¾" coal (bkn); 1⅛" med.gy.br.sh; ½" coal (bkn); 1¼" m.gy.fn.st; 9¼" coal;
			206'10" NOT TO SCALE 4'9" l.gy.sh.–slts. bet. 1'4½"–2'4½" from top;
			211'7" 1" carb.sh;
			211'8" 2¼" carb.sh; 1½" (p.bkn) coal;
			212'8" 6" (bkn) coal & inf.coal;
			2'9" l.gy.sh.–slts., ground away at top;
			5½" lt.gy.sh;
			10¾" carb.sh.–dk.gy.sh;
			10" med.–dk.gy.sh.–slts;
			9½" l.gy.slts;
			7¾" l.gy.sh;
			219'4¾" 4¼" carb.sh.;
M. 4·8 VM 39·1 F.C. 38·4 A 17·7 Joules/gm. 26,510 B.T.U./lb. 11,410 S 0·42 S.G. 1·37 2" sh. excl. in 2 bands marked +: A 62·8	92·3%	286/57	Excl. 6½" coal, ¾" l.gy.sh. ¾" fr. btm; ¾" dk.gy.sh.;
			17" coal (bkn. in btm. 6");
		Excl.	4½" carb.sh. impreg.w. iron carb; 8" coal;
		Excl.	222'7¼" 1¾" dk.gy.–carb.sh; 2" inf.coal;
			10½" dk.gy.–med.gy.sh;
			2'3½" l.–med.gy.sh;
			11½" l.gy.sh.; 1½" med.–dk.gy.sh; 1¾" coal; 1¾" carb.sh;
			3'1½" (p.bkn) l.gy.sh.–slts in places & impreg with iron carb. bet. 23¾"–2'6" fr. top 4 $CaCO_3$ bet. 27¾" & btm.;
			231'6" 4¼" dk.gy.sh; 1¼" carb.sh; ½" dk.gy.sh;
			7" (bkn) coal;
			232'7½" ¾" carb.sh.; ¾" inf.coal;
			1'8" lt.gy.slts;
			6½" lt.gy.sh;
			235'0¼" ½" m.–dk.gy.sh; ¾" carb.sh;
			5½" coal (bkn);
			2" carb.sh. (bkn);
			7" coal (p.bkn);
			238'2¼" 3" dk.gy.sh.
			Floor: sh.

Overall recovery 91·3%

N.S. 87

Prox. Analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			133'9" Roof: sh.; 3¾ coal w. 1" inf. coal at ½"; 10¼" (p.bkn) fn.sh.;
A 28·7 S.G. 1·49 8" sh. excl. in 2 bands: A 55·6	88·0%	500/57	135'1" 4¾" (p.bkn) coal; ¼" fn.sh.; 2¾" coaly.sh.–carb.sh.; ¾" inf.coal; 1" fn.sh.; ½" inf.coal; ¾" carb.sh.; 4½" (p.b) coal; ½" cb.sh.; ½" fn.sh.; 1" cb.sh.; 2¼" coal; ½" carb.sh.;
		Excl.	137'2" 2¼" fn.sh.; ¼" carb.sh.;
		Excl.	8" (p.bkn) coal;
M 5·5 VM 37·6 F.C. 35·1 A 21·8 Joules/gm 24,540 B.T.U./lb. 10,560 S 0·40 S.G. 1·42 2¼" sh excl. in two bands marked +: A 74·8	95·3%	492/57	1½" l fn sh; 8¾" (p.bkn) coal; ½" fn.sh.; 2" carb.sh.; 1" coal; 2½" coal w. few ¼" carb.sh. bds.; 5½" fn.sh.; ½" carb.sh.; 4" coal; ¼ carb.sh.; 1" fn.sh.; ½" carb.sh.;
		Excl.	1'3" coal;
		Excl.	141'7½"
			7'3¾" l.gy.sh w. thin bands of l.gy.slts & fsa from 2'2"–4'0";
			145'6½" 2¼" d.gy.sh.; 1¾" coal;
A 19·3 S.G. 1·40	100%	502/57	2¾" fn.sh.; ¼" coaly sh; 4½" (p.b) coal; 1½" inf.coal; 3¾" coal; ½" carb.sh.; 8" (p.b) coal;
			151'1½" ½" carb.sh.; ¾" d.gy.sh.; ½" (p.b) coal; 4" m.gy.–d.gy.sh.; 1'0" l.gy–m.gy.sh.;
			¾" inf.coal;
			153'3" Floor: l.gy.sh.

Overall recovery 92·0%

MINE WORKINGS 'B'

Seam Section	Description
	Roof: l.gy.sh; 10" l.–m.gy.sh. w. few thin coal bands; 5½" coal–inf. coal; 8" gy.wh.waxy sh.; 9" d.gy sh. w 1½" gy.wh.waxy sh. in mid.; 1" coal; 2½" coal & fn.sh. bands; 3½" coal; 1" fn.sh.; 7" coal w ½" fn.sh. in mid.; 2½" fn.sh; 8" coal; 2½" fn.sh; 7" coal; 1" fn.sh; 4" coal; ¾" gy.sh; 2¼" coal; 4" fn.sh. granite; 5" coal; ¾" fn.sh.; 1'2½" coal;
5'7"	3'2" l.gy.slts;
	6¼" coal; 1" fn.sh; 7" coal; Floor: sh.

In all boreholes except N.S. 87 another three persistent coal plies were encountered within 9-16 ft. of the Lower seam (see fig. 7) but only in borehole N.S. 86 are they sufficiently close together to present a possibly workable section. Poor core recovery in the bottom band of coal, however, makes appraisal difficult. This bottom coal occurs at the base of a succession of coal and shale beds extending for 30-50 ft. below the roof of the Bottom seam. This coaly sequence and the overlying Top seam can be correlated, as mentioned previously, with the Rosewood seams of the Perry's Knob area.

In borehole N.S. 84 coalbearing strata were encountered for another 440 ft. below the Rosewood seams. Although no section of workable coal was penetrated in this part of the succession, two seams, occurring at depths of 290 ft. 5 in. and 504 ft. 9 in., possess some potential. These seams are tentatively correlated with the New Malabar and Lowfield seams, respectively (Cameron, 1959).

Drilling was continued in N.S. 84 to a depth of 780 ft. For 92 ft. below the last seam encountered, that is, from 680 ft. to 772 ft., the strata consist of fine-grained sandstone, siltstone and shale of similar lithology to that of the overlying beds but without coal seams. Below 772 ft., thin beds of coarse pebbly sandstone occur interbedded with the usual Walloon-type rocks. This bottom 8 ft. is correlated with the Marburg Sandstone which outcrops around Calvert, 4 miles west of the Smithfield No. 3 mine area.

STRUCTURAL GEOLOGY

Within the Smithfield mine area, the Walloon Coal Measures are practically horizontal. Because of local irregularities in the attitude of the beds, the regional dip is not exactly known but is no more than 2 degrees in a southerly direction. To date, no major faults have been encountered in the mine workings, an advantage which the drilling results suggest will not be lost in future development.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of shale bands normally removed in practice, of not more than 25 per cent. Reserve areas have been defined as extending no more than 5 chains beyond the most outlying of those points of observation (diamond drill holes or mine workings) at which the seam section satisfies the above three requirements. The status of these reserves depends on the distance between observation points—

(*a*) up to 12½ chains—measured reserves;

(*b*) more than 12½ chains—indicated reserves.

Workable sections were penetrated in the **Top seam** in boreholes N.S. 84 (5 ft. 5 in.) and N.S. 86 (3 ft. 1½ in.), the reduced thickness in N.S. 86 being due to deterioration of the top coal (see Fig. 4). Although good quality coal undoubtedly exists in the Top seam around borehole N.S. 84, the seam has not been tested between that area and the abandoned Smithfield No. 3 Top seam workings 20 chains to the north. Consequently, no attempt has been made to estimate reserves in this seam.

Measured reserves established in the **Bottom seam** extend over 40 acres and amount to 330,000 tons. The working section in this area which embraces boreholes N.S. 84 and N.S. 87-88 lies above the thick stone and includes about 1 ft. 9 in. of coal with thin shale bands previously left in the roof. Average thickness is 6 ft. 1½ in., including 4 ft. 10 in. of coal. Weighted average ash content is 21·5 per cent.

Towards boreholes N.S. 85-86, the section of the Bottom seam above the thick stone becomes unworkable because of deterioration of the coal above the persistent fawn shale band. In this area, however, the two coal plies of the Bottom seam beneath the thick stone and the underlying **Lower seam** are sufficiently close together to provide a workable section. If all three coal plies were worked, the average thickness of coal would be 5 ft. 8½ in., the section varying from 7 ft. 4 in. to 8 ft. 6½ in. thick. Measured reserves with a weighted average ash content of 22·8 per cent. amount to 120,000 tons.

NATURE OF COAL

The coal from the Top, Bottom and Lower seams of the Smithfield No. 3 mine area is of high-volatile bituminous rank. Fixed carbon calculated on a dry mineral-matter-free basis ranges from 49·5 to 52·6 per cent. Calorific value calculated on a moist mineral-matter-free basis ranges from 13,340 to 14,170 B.T.U.'s per lb. As a rule, Walloon coal is only weakly coking.

CONCLUSIONS

Measured reserves were established by the diamond drilling programme in the Smithfield No. 3 mine area in the following seams:—

	Tons
Bottom seam	330,000
Lower seam	120,000
Total	450,000

Over 70 per cent. of these reserves lie in the present working seam but above the thick shale band, the rapid growth of which was responsible for curtailing dip development in 1957. This coal is now being actively exploited. The remaining reserves are also readily accessible, lying no more than 6 ft. below the Bottom seam and adjacent to its western limit of workability (see Fig. 2).

FIG. 6

SMITHFIELD No 3

DIAGRAMS OF BOTTOM & LOWER SEAMS — CORE RECOVERY AND ANALYSIS

N.S. 85

Prox.Analysis S.,Cal.value,SG. | Recovery percent | Section Sampled | Seam Section | Description

A.R 21·5 SG 1·42 — 89·7% — 435/57 — Excl.

M.R 4·0
VM 39·4
FC 39·8
A.R 15·9
Joules/gm 27,250
BTU/lb. 11,720
S.R 0·53
SG 1·37
2·2m excl. in 2 bands:
A.R 18·9

95·1% — 487/57 — Excl.

M.R 4·4
VM 38·9
FC 37·0
A.R 19·7
Joules/gm. 25,890
BTU/lb. 11140
S.R 0·42
SG 1·40

87·5% — 488/57

M.R 5·2
VM 37·0
FC 38·6
A.R 19·2
Joules/gm. 25,470
BTU/lb. 10,960
S.R 0·53
SG 1·41
2·3m excl. in 2 bands:
A.R 74·8

Excl.

Excl.

83·7% — 489/57

A.R 19·3 SG 1·39 — 48·4% — 496/57

Overall recovery 91·0%

N.S. 86

Prox.Analysis S.,Cal.value,SG. | Recovery percent | Section Sampled | Seam Section | Description

A.R 19·4 SG 1·40 — 100% — 497/67 — Excl.

M.R 4·8
VM 38·4
FC 37·3
A.R 19·5
Joules/gm. 25,590
BTU/lb. 11,010
S.R 0·41
SG 1·40
2·2m excl. sh band marked *:
A.R 75·2

90·8% — 490/57 — Excl.

A.R 21·2 SG 1·42 — 83·0% — 498/57 — Excl.

A.R 16·3 SG 1·37 — 65·7% — 499/57

Overall recovery 85·7%

N.S. 88

Prox.Analysis S.,Cal.value,SG. | Recovery percent | Section Sampled | Seam Section | Description

A.R 28·2 SG 1·47
3¾"sh excl. in 2 bands:
A.R 68·9

M.R 6·0
VM 36·1
F.C 38·2
A.R 19·7
Joules/gm 25,110
BTU/lb. 10,800
S.R 0·49
S.G. 1·40
7½"sh excl. in 3 bands marked *:
A.R 67·2

93·5% — 503/57 — Excl. — Excl.

96·3% — 493/57 — Excl. — Excl. — Excl.

A.R 13·7 SG 1·20
2"excl. sh. band:
A.R 71·4

89·0% — 504/57 — Excl.

A.R 23·0 SG 1·43
1"excl sh band
A.R 78·1

89·8% — 505/57 — Excl.

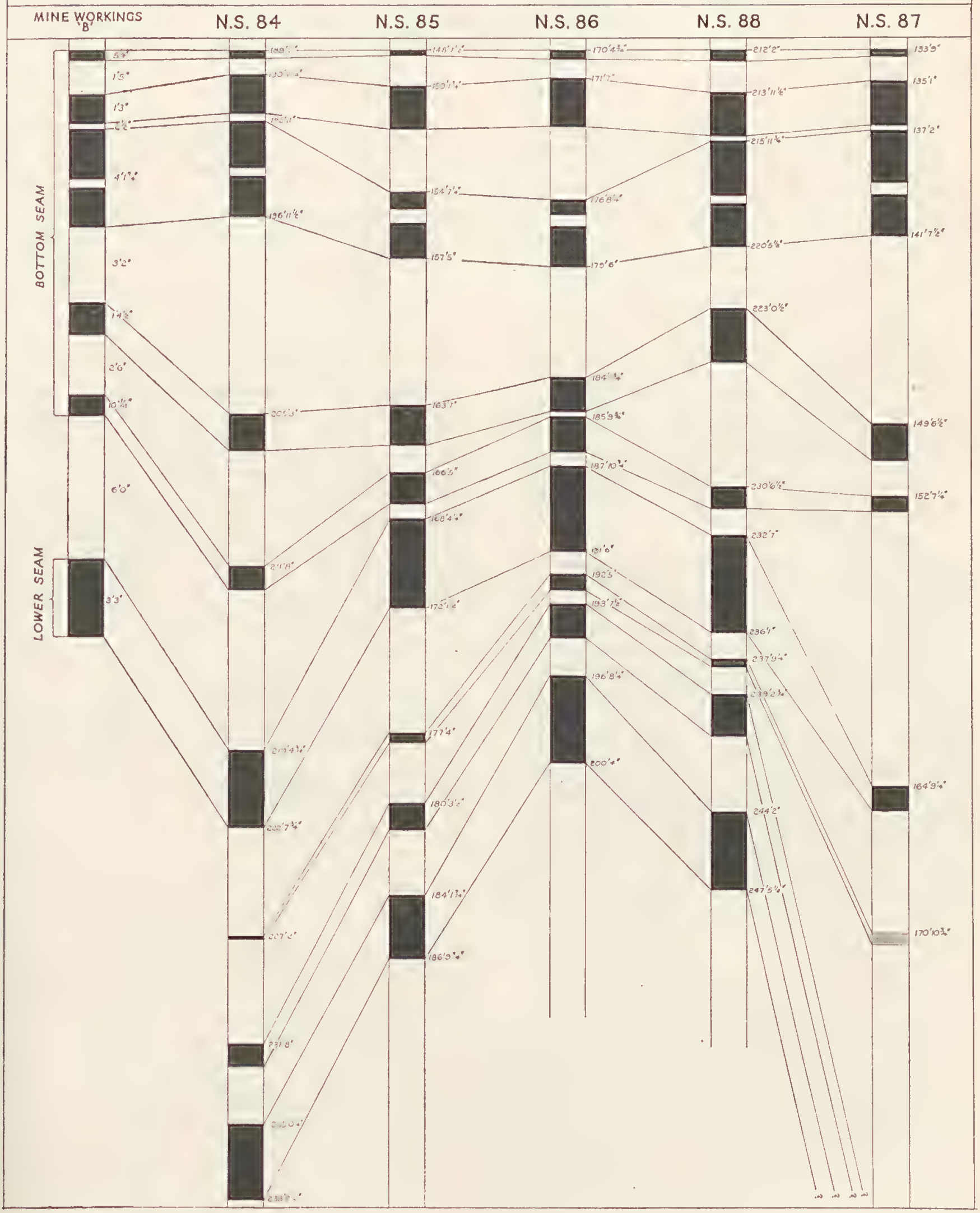
A.R 16·4 SG 1·36 — 48·7% — 506/57

Overall recovery 89·3%

FIG.7

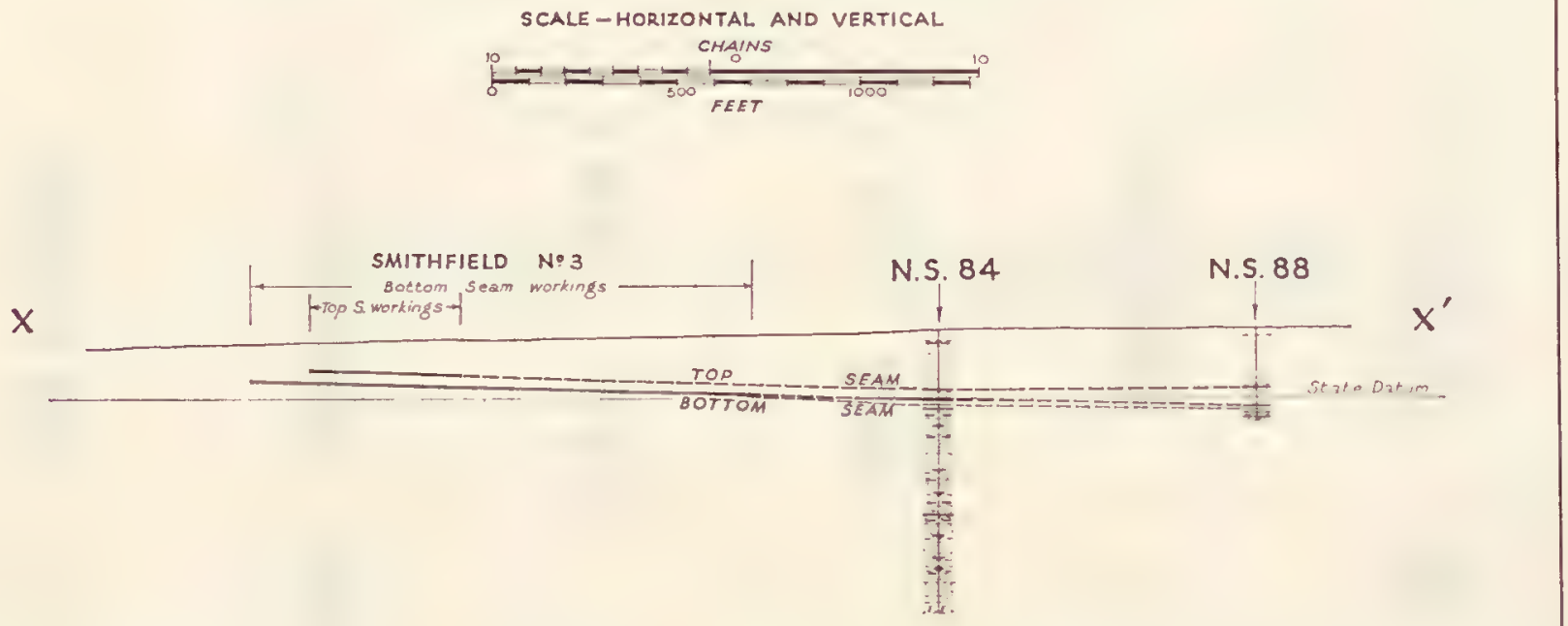
SMITHFIELD No.3

GENERALISED CORRELATION DIAGRAM — BOTTOM & LOWER SEAMS



C

FIG. 8



The average ash content of the Bottom and Lower seam reserves is estimated to be 21·5 and 22·8 per cent. respectively, the following percentages of stone being discarded:—

	By Volume per cent.	By Weight per cent.
Bottom seam . .	22	29
Lower seam . .	28	37

Since the sampling procedure adopted does not exactly reproduce the coal-cleaning methods now employed at Smithfield No. 3 Colliery, some variation in the above figures can be expected. In practice, the ash content of the coal finally marketed will most likely be somewhat lower than that estimated and the percentage of stone discarded slightly higher. The Bottom seam reserves then would appear to be of similar quality to the coal now being produced; at present, in addition to the stone handpicked and packed underground, another 25-28 per cent. by weight of the "run-of-mine" coal is discarded by washing, the ash content of the washed coal being 15 and 18 per cent. for minus 1 in. and 1-4 in. sizes, respectively. On the other hand, the reserves in the Lower seam do not appear as attractive because of the high calculated percentage discard. However, the thick stone in borehole N.S. 85 which is responsible for this occurs in two bands 1 ft. 1½ in. and 1 ft. 9 in. thick and so could be readily excluded by selective mining. If the stone to coal ratio around borehole N.S. 85 is excessive, a 4 ft. 2 in. section could be worked in this area by leaving the bottom 1 ft. 9 in. band as the floor. With this arrangement, measured reserves available in the Lower seam would be reduced to approximately 85,000 tons.

REFERENCES

CAMERON, J. B., 1959: Coal resources—Rosewood–Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

REID, J. H., 1922: Geology of the Walloon–Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

23rd November, 1959.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(ROSEMOUNT No. 4 MINE AREA)

By J. B. CAMERON

SUMMARY

Drilling to assess reserves in Rosemount No. 4 mine area comprised fourteen holes totalling 3,290 ft. 10 in.

Workings in the New Malabar seam terminated to the north-east on a fault with upthrow of 30 ft. in that direction, and to the north splitting of the seam made it unworkable. Drilling disclosed reserves to the north-east of the fault in two areas, separated by a corridor in which the seam is split by several feet of shale.

The Lanefield No. 5 seam was shown to be workable in an area extending northerly from present workings and also to the south.

Total measured reserves thus established are—

	Tons
New Malabar seam—	
Northern area	90,000
Southern area	120,000
Lanefield No. 5 seam—	
Northern area	350,000
Southern area	330,000
	890,000

Because of lease conditions, however, reserves available for extraction are reduced to 810,000 tons. Of this, only 370,000 tons in the Lanefield No. 5 seam is immediately exploitable. The remainder, in both New Malabar and Lanefield No. 5 seams, lies beyond the fault and access to it from the present tunnel would entail a considerable amount of unproductive work. The northern area of reserves in the New Malabar seam could, however, be readily entered from the adjacent Oakleigh Colliery.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

In October and November, 1953, during the testing of the Lanefield No. 5 mine area immediately to the west, two diamond drillholes, N.S. 19 and N.S. 21, were drilled by the Department of Mines in the Rosemount No. 4 mine area. It was not until 1958, however, that an extensive programme of coal exploration was undertaken. In the period, March to July of that year, a further twelve holes, N.S. 114-115 and N.S. 121-130, were drilled, also by the 22 H.D. No. 1 plant. Due to poor recovery in the topmost seam in borehole N.S. 122, a second shallow hole, N.S. 123, was drilled at that site. Overall core recovery for the complete fourteen holes, however, was quite satisfactory, averaging 96·9 per cent. Total footage drilled was 3,290 ft. 10 in.

All workable coal sections penetrated during the drilling programme were examined by an Engineer Member of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone both underground and on the surface. All analyses were carried out by the Government Analyst. Seam correlation is based on geological work carried out by W. L. Hawthorne, Assistant Geologist, in 1951, and the writer since 1953.

Accompanying the report are the following plans, sections and diagrams:—

(*a*) Locality Plan—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and boundaries of measured reserves—fig. 2.

(*c*) Generalised bore sections—fig. 3.

(*d*) Diagrams of seams showing sections analysed and results—
New Malabar seam—fig. 4.
Lanefield No. 5 seam—figs. 5, 6, and 7.
Lowfield seam—fig. 7.

(*e*) Three cross sections—fig. 8.

MINE WORKINGS

Rosemount No. 4 Colliery is situated just over one mile north-north-west of Rosewood Railway Station. The workings lie within Coal Mining Lease No. 317 held by Rosemount Colliery Pty. Ltd. To date, two seams have been worked. The Top seam which outcrops to the west can be correlated with the New Malabar seam of the Glencoe mine area (Cameron, 1961), while the Bottom seam is equivalent to the working seam of Lanefield No. 5 Colliery (Cameron, 1956).

Workable coal was first encountered in this mine area in the early 1920's, the occurrence of coal seams between 71 ft. and 93 ft. in Dale's bore (see fig. 2) being recorded by Reid (1927). Although an access tunnell was driven to the Top seam in 1940, coal production did not commence at Rosemount No. 4 Colliery until nearly two years later. This delay was due to the fact that the working section first exposed was only 3 ft. thick. Further prospecting, however, showed that there was another 20 in. of coal several feet below and that to the south the stone between

these two sections of coal thinned rapidly to only a few inches. To the dip then, seam thickness was nearly 5 ft. Mining operations were confined to this New Malabar seam until 1954 when a cross measure drift was driven to intersect the Lanefield No. 5 seam about 80 ft. beneath. Since 1956, all production has come from this lower seam.

GENERAL GEOLOGY

The coal seams so far worked in the Rosemount No. 4 mine area occur approximately 150-250 ft. below the top of the productive beds of the Walloon Coal Measures. The upper seams which have been eroded over the greater part of this area are well developed, however, to the north-east around Perry's Knob where as previously described (Cameron, 1959) the complete Jurassic coalbearing sequence has been preserved by a protective capping of Tertiary basalt.

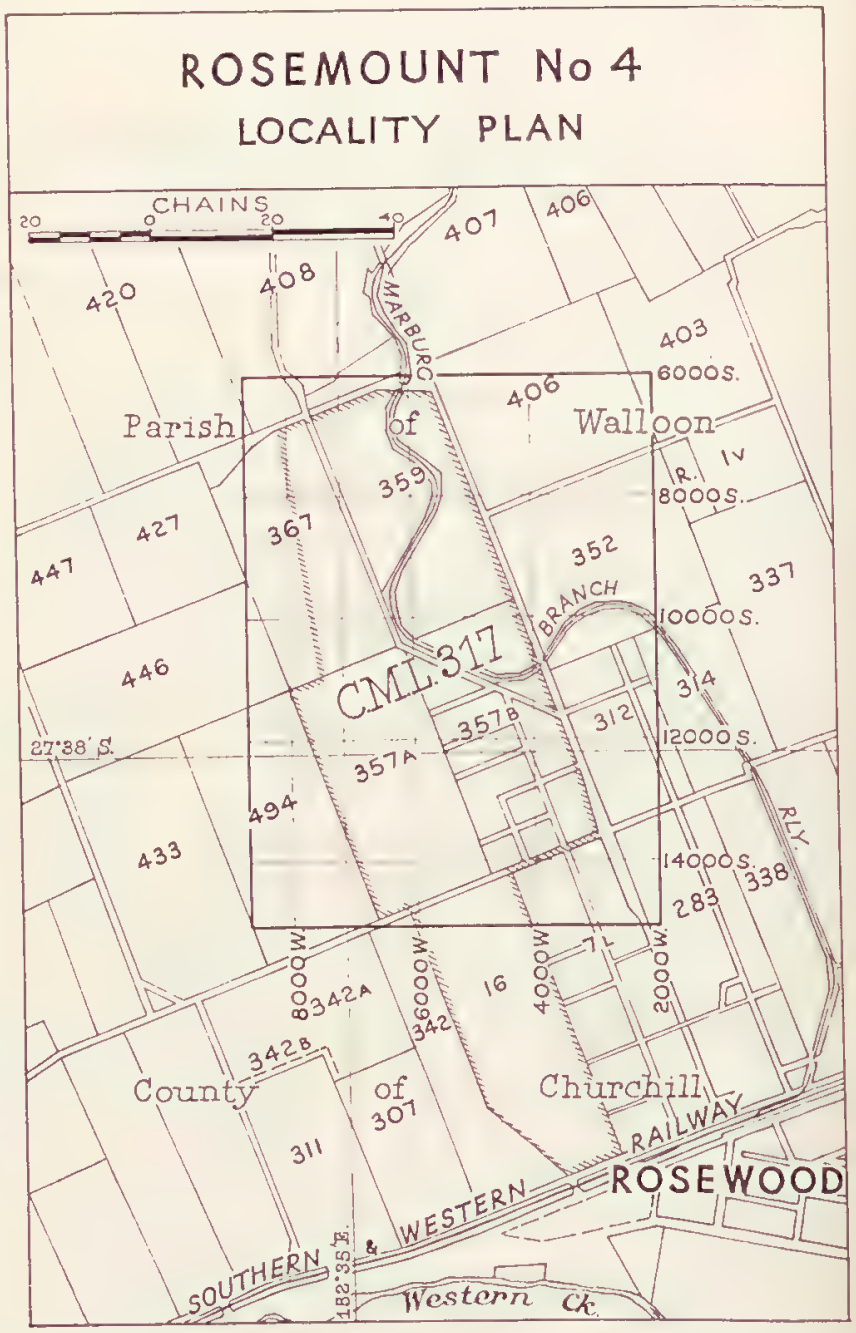
SUBSURFACE GEOLOGY

In the Glencoe mine area to the north-east of Rosemount No. 4 Colliery, the New Malabar seam lies 60-80 ft. below the **Glencoe Nos. 1-4 seams,** four productive horizons which constitute a coalbearing sequence some 60 ft. thick. These **Rosewood seams,** as they were called by Reid (1922), were not cored in any of the diamond drillholes but were undoubtedly penetrated in the open hole sections of boreholes N.S. 114 and N.S. 121 which are only a few chains from the old Glencoe workings (see fig. 2). Because of their limited extent, these Rosewood seams are of no economic interest in the Rosemount No. 4 mine area.

In the access tunnel of Rosemount No. 4 Colliery, the New Malabar seam is immediately overlain by a succession of coal and shale bands over 4 ft. thick. Such is the case also in borehole N.S. 127. In the other diamond drillholes in the area, however, this coaly horizon lies 3-20 ft. above, the intervening strata being shale or sandstone. The "bentonite" band which is so characteristic a feature of this particular part of the succession in other areas of the coalfield was cored only in boreholes N.S. 21 and N.S. 114 where it occurs about 50 ft. above the New Malabar seam.

When the drilling programme commenced in the Rosemount No. 4 mine area in 1958, all available coal in the **Top** (or **New Malabar) seam** had been exploited. To the west, the seam had been worked to crop while to the north-east, development had been stopped by faulting (see fig. 2), the seam, as proved by a percussion drillhole, being upthrown to the east about 30 ft. In all other directions, the limit of workability had been reached. In the south, the working section decreased in thickness till at the face of the main dip it was no more than 2 ft. 6 in. This point is less than three chains from the No. 1 Government Bore which was drilled by the Mines Department in 1926 (Reid, 1927). Only 11 in. of coal was recorded in the New Malabar seam there at a depth of 93 ft. As previously mentioned, the seam was unworkable north of the colliery workings due to the splitting off of the bottom 20 in. of coal by the growth of a shale

FIG. 1



band to at least 2 ft. The only possible direction for future mine development in this seam was to the north-east beyond the fault.

In this area workable coal was penetrated in the New Malabar seam in boreholes N.S. 115, N.S. 121, and N.S. 122-123 and N.S. 127 (see fig. 4). The seam was not cored in boreholes N.S. 124-125, occurring there at depths of only 61 ft. and 38 ft., respectively. In boreholes N.S. 114 and N.S. 126 to the east of Rosemount No. 4 pithead, however, the seam is split by a grey shale band 1 ft. 8 in. to 2 ft. 8in. thick. This thick stone is the same band which first hindered mine development at Rosemount No. 4 Colliery. To the north-east of the fault then, the New Malabar seam is workable in two areas—around boreholes N.S. 115 and N.S. 121-123 to the north and in the vicinity of borehole N.S. 127 in the south. Between these two areas there is a corridor extending from Rosemount No. 4 tunnel towards borehole N.S. 114 in which the "bottoms" of the seam are split off by several feet of shale. Departmental diamond drilling has shown that this corridor of thick stone in the New Malabar seam extends eastward through Glencoe and Normanton No. 1 mine areas.

FIG. 2

DEPARTMENT OF MINES QUEENSLAND

ROSEMOUNT No4 MINE AREA
ROSEWOOD–WALLOON COALFIELD

Showing boreholes, mine workings, topography and boundaries of measured reserves

To accompany report by J.B.Cameron B.Sc.App(Geol), Geologist

Topographic survey by Ewan Cowley, Asst. Surveyor

SCALE OF CHAINS 0 10 20

SURVEY DATA

Twenty chain grid on True North. Origin of grid Perry's Nob Trig. Station
Elevations in feet on State Datum

EXPLANATION

Colliery (working)	NEATH	Colliery (abandoned)	NEATH A
Shaft		Diamond drillhole	
Percussion drillhole	PD.	Adit	
Surface contour	60	Cross section line	A'—A''
Seam section measured	A	Underground level	65'
Fault (New Malabar Seam)			
Limits of measured reserves, New Malabar Seam			
Lanefield No5 Seam			
Limits of mine workings in - New Malabar Seam			
Lanefield No 5 Seam			

OAKLEIGH WKGS

Area in New Malabar Seam sub-leased to Oakleigh Colliery Company

N.S. 122/123 R.L. COLL 277.30 R.L. SURF 275.80

N.S. 125 R.L. COLL 253.95 R.L. SURF 252.70

N.S. 121 R.L. COLL 339.50 R.L. SURF 337.75

N.S. 115 R.L. COLL 290.37 R.L. SURF 289.20

N.S. 114 R.L. COLL. 344.59 R.L. SURF. 343.17

GLENCOE WORKINGS

N.S. 51

N.S. 52

N.S. 53

N.S. 124 R.L. COLL 264.55 R.L. SURF. 263.20

P.D. R.L. SURF 239.50

N.S. 126 R.L. COLL 279.88 R.L. SURF 278.55

NORTH ROSEWOOD

N.S. 127 R.L. COLL 269.69 R.L. SURF 268.61

P.D. R.L. SURF 243'

ROSEMOUNT No4

WORKINGS

LANEFIELD No5

N.S. 128 R.L. COLL. 219.55 R.L. SURF. 218.30

N.S. 129 R.L. COLL 184.45 R.L. SURF 193.12

N.S. 21 R.L. COLL 207.25 R.L. SURF 206.22

N.S. 130 R.L. COLL 178.84 R.L. SURF. 177.01

N.S. 16

N.S. 19 R.L. COLL 156.80 R.L. SURF 155.80

No.1 GOV. BORE R.L. 171.53

8000 S

10000 S

12000 S

14000 S

8000 W

6000 W

4000 W

2000 W

367

359

357A

357B

494

352

312

283

16

7L

FIG. 3

ROSEMOUNT No 4

GENERALISED BORE SECTIONS

FIG. 4

ROSEMOUNT No 4

DIAGRAMS OF NEW MALABAR SEAM DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 114

Prox. analysis S, Cal. value, S.G.	Recovery Percent	Section Sampled
M% 7·7 V.M% 32·6 F.C% 36·2 A% 23·5 Joules/gm. 22700 BTU/lb. 9770 S. 1·54 S.G. 1·456	85 5	
M% 7·5 V.M% 37·9 F.C% 41·9 A% 12·7 Joules/gm. 26890 BTU/lb. 11570 S 0·68 S.G. 1·342	100	

172'6¼" 1'1½" l.gy.sh.→m.gy. in btm. 2";
8" carb.sh;
1" inf. coal; 2¼" carb.sh;
1'fn.sh; ¾"(p.b) inf. coal;
10¾"(p.b) coal, w. 1" carb.sh. at 8¼";
173'11½" ¾" br.sh; 1¾" coal; ¼" carb.sh & pyrite,
½"(b) coal, ¾" carb.sh. & pyrite; 1½" cb.sh;
1'd.gy.sh; 3½" carb.sh;
1'd.gy.sh; 2¾" carb.sh;
1'(b) coal; 5¼" m.gy.sh;
¾" carb.sh.→inf. coal; ½" carb.sh;
175'8" 2½" m.gy.sh.;
1'8" coal w. 1" inf. coal at 7";
177'4" 1'11½" l.gy.sh.

N.S. 115

Prox. analysis S, Cal. value, S.G.	Recovery Percent	Section Sampled
M% 7·5 V.M% 36·0 F.C% 39·8 A% 16·7 Joules/gm. 25570 BTU/lb. 11000 S. 0·62 S.G. 1·363	89 0	Excl. Excl.

3'9½" l.gy.sh;
1½" med.gy.sh;
3¼(p.b) coal; 1" inf. coal→carb.sh;
100'9½" 5¾" l.gy.sh; 1" carb.sh;
1'0½"(b.) coal;
3¾"(p.b.) inf. coal;
5¼" inter bd. inf. coal & carb.sh.;
7¾" inf. coal→coal;
½" carb.sh.;
6¾"(p.b) coal;
1¼"(b.) br.sh.;
1'0¾"(p.b.) coal;
1¾"(p.b.) inf. coal; ½" carb.sh;
8¾"(p.b.) coal;
106'5½" 1'11" l.gy.sh.

N.S. 121

Prox. analysis S, Cal. value, S.G.	Recovery Percent	Section Sampled
M% 4·5 V.M% 37·3 F.C% 38·8 A% 19·4 Joules/gm. 25400 BTU/lb. 10930 S. 0·49 S.G. 1·378	96 3	Excl.
M% 5·4 V.M% 37·7 F.C% 43·2 A% 13·7 Joules/gm. 27390 BTU/lb. 11780 S. 0·58 S.G. 1·344	100	

2'11½" l.gy.sh;
½" carb.sh; ¼" fn.sh; 2" coal;
1¾" inf. coal; 1" carb.sh; 1¼" inf. coal;
154'6¼" 4" dk.gy.sh;
2¼" coal, ½" fn.sh;
7¼"(p.b) coal;
2½" l.gy.sh; ¾"(b) coal;
5¾"(b) carb.sh;
156'9" 7" coal;
4" gy.sh w. tiny nod. of iron carb.;
157'1¾" ¾" carb.sh;
1'0½"(p.b) coal→inf. coal in places;
1½" carb.sh;
159'0½" 8¾"(p.b) coal;
1'10" l.gy.sh.→slts. in places.

N.S. 123

Prox. analysis S, Cal. value, S.G.	Recovery Percent	Section Sampled
M% 5·7 V.M% 37·4 F.C% 41·3 A% 15·6 Joules/gm. 26230 BTU/lb. 11290 S. 0·53 S.G. 1·357	97 4	Excl. Excl.

1'10½" l.gy.f.arg.sa w. m.gy.sh lenses in btm. 8";
3"(b.) inf. coal & coal;
73'11¼" 4½" carb.sh;
3¾"(p.b) coal; 1½" carb.sh.;
1'3"(b.) coal;
3½" dk.gy.sh;
1'11¼"(b.) coal w. 1" coaly sh. at 1'1";
77'11" 1'6" med.gy.sh.

N.S. 126

Prox. analysis, S, Cal. value, S.G.	Recovery Percent	Section Sampled
		no sample

1'8" l.gy.sh, w. iron carb. in btm. 2½";
5" d.gy.sh.→carb.sh.;
1'2" carb.sh.;
102'7"
10¼"(b.) coal;
103'9¼" 9¼" carb.sh;
2" fn.sh; 1¼" carb.sh;
7¾" d.gy.sh.→carb.sh.;
8½" carb.sh;
106'5¼" 3¼" d.gy.sh,
1'7"(b.) coal w. ¾" inf. coal at 11";
108'2¾" 1'4¾"(p.b) l.gy.sh→slts. in pl.

N.S. 127

Prox. analysis S, Cal. value, S.G.	Recovery Percent	Section Sampled
M% 5·3 V.M% 35·1 F.C% 39·7 A% 19·9 Joules/gm. 25230 BTU/lb. 10850 S. 0·50 S.G. 1·415	96 3	Excl. Excl.
M% 6·0 V.M% 37·9 F.C% 44·9 A% 11·2 Joules/gm. 27780 BTU/lb. 11950 S. 0·53 S.G. 1·341	87 5	

7" l.gy.sh., slickensided;
4½" carb.sh;
8" dk.gy.sh;
½" carb.sh; 3"(p.b) coal;
1¼" carb.sh;
4½" dk.gy.sh. w. i carb. nodules top 4";
2¾"(b.) coal; 2¾" carb.sh;
2¼" dk.gy.sh; 1¼" carb.sh;
¼" fn.sh, 1¼" carb.sh, ½" coal;
110'4"
9¾"(b.) coal;
1" d.gy.sh; 2¼" coal;
¼" fn.sh; 1¾"(b.) coal; 1"(p.b) carb.sh;
2¾"(b.) coal; 1½" carb.sh.;
112'7" 6¾"(b.) coal;
113'0½" 5½" l.gy.sh.→m.gy.sh.;
1'5½"(b.) coal;
114'8½" 1'11½" med.gy.sh.→slts. in pl.

UNDERGROUND 'A'

1'2½" l.gy.slts;
3½" coal; ½" carb.sh;
1" coal; 3" carb.sh.;
3" coal; 2" inf. coal;
4½" med.gy.sh;
2" coal; 1½" l.gy.sh;
1'6" coal;
2'10½" 1" l.gy.sh.;
1'3½" coal;
6'3½" 1'9" l.gy.sh;
1'8" 1'8" coal;
Floor: sh.

FIG. 5

ROSEMOUNT No 4

DIAGRAMS OF LANEFIELD No5 SEAM DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 19

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
		no sample	6" sand gy s'st; 1" carb sh; 6" bl coal; 5" m gy sh, w coal lents btm ½"; 6½" (pb) coal; 154'5¾" 4" l gy sh w coal & carb lents btm 2"; 4¼" l gy slts; 1'0" l. gy. sh; 156'2" ½" inf. coal, 2" coal, 2¾" inf. coal; 1" l gy sh; 4¾" coal w ¼" l gy sh at 4"; 1½" d gy sh; 6½" coal; 158'1½" 4" inf coal w (pb) sh; 5" intbd l gy f sa & l gy sh; 3" l gy f sa; 10" l gy sh; 159'11¼" 2¼" carb sh; ½" l gy sh; 3" inf coal; 6" carb sh; 3" coaly sh; 3" coal; 1" coaly sh; 8¼" carb sh w ½" l gy sh at 1¼"; 162'0½" ¼" coal; 8½" l gy slts.

N.S. 21

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
		no sample	2'7" l gy slts; 219'0" 2½" l gy sh, ½" carb sh, 4" coal & inf coal, 1¼" carb sh; 1'1" (pb) coal; ½" carb sh; 1" l gy sh; ½" carb sh; 3" (pb) coal; 222'2½" 2" (pb) d gy sh; 2¾" (pb) carb sh; 11¼" l. gy sh; 223'1¾" 8¼" (pb) carb sh; 2½" (pb) inf. coal; 224'2½" 2½" carb. sh; 10½" l gy. slts.

N.S. 114

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
			1" l. gy sh → med. gy sh, 2" d gy sh; 2" carb sh; 9¾" d gy sh; 2¼" fn sh; 245'10" 4¼" carb sh; 1½" l fn sh; 1'7½" coal, ½" fn. sh; 1'10½" (pb) coal,
M% 4·5 VM% 36·4 FC% 37·1 A% 22·0 Joules/gm. 24720 BTU/lb. 10420 S. 0·51 SG. 1·407	100		249'4½" ¾" d gy sh, 4" l gy sh; 1'6½" intbd. l gy sh & gy wh f sa;
M% 4·9 VM% 36·4 F.C% 39·9 A% 18·8 Joules/gm. 25940 BTU/lb. 11160 S. 0·59 SG. 1·383	100	Excl. Excl.	251'3¾" ¾" inf coal, ¼" coal w ¼" sh at 2¾", ½" fn sh; 2¾" coal, 2" carb sh, 1" inf coal, ¼" carb sh; 4" coal, ¼" fn sh; 253'3" ½" coal & ¼" sh am at 1'6"; ½" carb sh, 2" → 2"

N.S. 115

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
M% 5·2 VM% 37·0 FC% 36·4 A% 21·4 Joules/gm 23640 BTU/lb. 10170 S. 0·71 SG. 1·395	·00		1'0" l gy sh, 176'4¾" ¾" fn sh, 2½" (pb) coal, 2" carb sh, 1'4" (b) coal w ¼" fn sh at 2¾", ½" inf coal,
M% 5·5 VM% 34·8 FC% 40·3 A% 19·4 Joules/gm. 25100 BTU S 0·52 SG 1·396	·100	Excl.	178'8¾" (pb) carb sh, 1" fn sh 1½" carb sh, ½" m gy sh, 1" coal, 1'5" (b) coal w ¼" carb sh at 3¾", ¼" carb sh at 5¾", ¼" fn sh at 10", ¾" d gy sh 5" (bb) coal w ¼" carb sh at ½",

N.S. 121

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
			¾" dk gy sh; ½" fn sh w carb lents; 234'1" 2¼" carb sh, 11¼" coal; ½" carb sh;
M% 4·9 VM% 37·4 FC% 38·8 A% 18·9 Joules/gm 24940 BTU/lb. 10730 S. 0·50 SG. 1·387	100		3'2½" (pb) coal → inf coal in few places w ¼" fn sh at 1'2" & 2'0½";
			238'4¼" 3" carb sh;
			1'7¼" l gy slts w few sh lam btm 6";
M% 5·5 VM% 34·2 FC% 38·2 A% 22·1 Joules/gm 23850 BTU/lb 10260 S 0·65 SG. 1·420	88·6		2'2" gy-wh f sa w 1½" l gy sh at 1'9" & ¾" l gy sh at 1'11½"; 242'2¾" 1'3½" (b) coal & inf coal w ¼" fn. sh at 7½"; 243'8" 6" med gy sh, ½" carb sh, 3'11" l gy sh → slts in places.

N.S. 122

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
			14¼" med gy sh → d gy sh at 1'0"; 7" carb sh w 1" inf coal at 2'4"; 147'3¼" 18¼" coal; 3¼" carb sh; 149'7" 4½" coal;
		no sample	5'2" interbd gy-wh. f. sa and l gy slts → sh in places;
			155'2¼" 3½" carb sh, 1½" coal, 1¼" carb sh, 3½" (pb) coal, ¼" fn sh, ¾" carb sh, 11¼" (pb) coal w ¼" carb sh at 4½"; 156'10" 5¾" l gy sh w iron carb, 7'6" interbd med gy sh & l gy f sa

N.S. 124

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
M% 5·3 VM% 37·9 FC% 38·7 A% 18·1 Joules/gm 25090 BTU/lb. 10800 S. 0·61 SG. 1·381	99·0	Excl.	1'10½" med gy → dk gy sh; 137'6" ½" inf coal, 2¼" coal, ¾" d gy sh;
M% 5·7 VM% 34·0 FC% 39·2 A% 21·1 Joules/gm. 25440 BTU 9540 S 0·54 SG 1·406	100		14'7" 7" carb sh w 1" inf coal at 2'4", 18¼" coal, 3¼" carb sh, 4¼" coal, 5'2" interbd gy-wh. f. sa and l gy slts → sh in places; 155'2¼" 3½" carb sh, 1½" coal, 1¼" carb sh, 3½" (pb) coal, ¼" fn sh, ¾" carb sh, 11¼" (pb) coal w ¼" carb sh at 4½", 156'10" 5¾" l gy sh w iron carb, 7'6" interbd med gy sh & l gy f sa

In the Rosemount No. 4 mine area, the **Bottom** (or **Lanefield No. 5**) **seam** lies at intervals ranging from 68 ft. (N.S. 122) to nearly 100 ft. (N.S. 129) below the new Malabar seam; the intervening strata are sandstone overlying shale with several thin coal plies. Over the greater part of the mine workings, only the "tops" of the seam have been worked, this section being usually 3 ft. 6 in. to 4 ft. thick except in the eastern part of the colliery where the seam thickness decreased to only 3 ft. In the southern and south-western parts of the mine workings, however, the "bottoms" of the seam have also been included in the working section. This extra coal is approximately 2 ft. thick with several thin shale bands and is separated from the "tops" of the seam by about 6 in. of grey shale. Similar improvement in the working section of the Lanefield No. 5 seam is now evident in the more advanced places in the north of the colliery; there an additional 1 ft. of coal has been included in the working section due to the thinning of the shale between the "tops" and "bottoms" of the seam. The behaviour of this shale interbed beneath the earlier workings is not well known but in the Rosemount No. 4 airshaft it is reported to be 7 ft. thick. A similar decrease in the thickness of this stone both northwards and southwards also occurs immediately to the west in the workings of Lanefield No. 5 Colliery (Cameron, 1956).

The diamond drilling results indicate that over most of the area tested the Lanefield No. 5 seam follows the same general pattern of behaviour exhibited in the workings of both Lanefield No. 5 and Rosemount No. 4 Collieries. In boreholes N.S. 114, N.S. 121-122 and N.S. 126-127 to the north-east and east of the Rosemount No. 4 pithead, there is 2-5 ft. of stone between the "tops" and "bottoms" of the seam; in boreholes, N.S. 124 and N.S. 128-130, immediately to the north and south of the present workings, however, the two sections of coal can be worked together. Although this improvement in the working section is still evident in borehole N.S. 115, further north in the vicinity of borehole N.S. 125 the seam is unworkable due to deterioration of part of the "tops" to carbonaceous shale. Likewise, the improvement in the working section southwards is not maintained beyond boreholes N.S. 128-130, the Lanefield No. 5 seam in borehole N.S. 21 being represented by less than 2 ft. of coal. Detailed seam sections of the Lanefield No. 5 seam together with analytical results are shown in figs. 5, 6, and 7.

Drilling was continued in borehole N.S. 19 to a depth of 390 ft. 4 in. and approximately another 200 ft. of coalbearing strata were encountered below the Lanefield No. 5 seam. However, only two workable sections were penetrated in this part of the succession, one at 229 ft. 4 in. and the other at 355 ft. 9½ in. Because of its depth and limited thickness (3 ft. 3 in., including 4 in. of carbonaceous shale), the latter seam was not considered of commercial interest. The seam at 229 ft. 4 in., however, was tested in three other boreholes, N.S. 21, N.S. 115, and N.S. 121 (see fig. 7) but was workable only in N.S. 21. This seam can be correlated on stratigraphic grounds with the **Lowfield seam** (Cameron, 1956).

STRUCTURAL GEOLOGY

Regional dip of the Walloon Coal Measures in the Rosemount No. 4 mine area is approximately 2 degrees to the south-east. Only one major fault has been encountered in the Top (or New Malabar) seam workings (see fig. 2). Although a percussion borehole sunk by the colliery management at a point some fifteen chains to the east of Rosemount No. 4 tunnel showed that the seam had been upthrown approximately 30 ft. to the east, no attempt was made to reach the coal beyond this fault from the underground workings. The behaviour of the fault to the north-west can be judged only from borehole information but a dislocation of similar magnitude can be expected in the future Lanefield No. 5 seam workings in that part of the mine area (see cross-section B′B″, fig. 8).

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings)—

(*a*) measured reserves—up to 12½ chains;
(*b*) indicated reserves—more than 12½ chains.

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

Measured reserves were established by the drilling programme in the Rosemount No. 4 mine area in both the New Malabar and Lanefield No. 5 seams.

Reserves have been calculated in the **New Malabar seam** in two areas (see fig. 2), both of which lie to the north-east of the fault which stopped development in the abandoned Top seam workings. (i.) In the northern area of 14 acres embracing boreholes N.S. 115 and N.S. 121, seam thickness varies from 4 ft. 6 in. to 5 ft. 8 in., the average thickness of coal being 4 ft. 0½ in. Measured reserves with a weighted average ash content of 16·1 per cent. total 90,000 tons. A small area of workable coal undoubtedly exists in the New Malabar seam west of the area defined. Extraction of this coal, however, would not be possible from workings to the east of the Marburg Branch Railway as the depth of cover beneath the railway line in this area is not quite 100 ft. (ii.) Measured reserves have also been calculated in the New Malabar seam further to the south around borehole N.S. 127. These reserves extend over 19½ acres and amount to 120,000

FIG. 6

ROSEMOUNT No 4

DIAGRAMS OF LANEFIELD No5 SEAM DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 125

Prox. analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			3'5¼" l gy. f. sa. → slts in pl w few l gy. sh. bands;
M% 7·0 VM% 36·1 FC% 41·4 A% 15·5 Joules/gm. 26750 BTU/lb. 11530 S. 0·51 S.G. 1·552	95·9	Excl	4" carb sh; 107'9½" 2" carb sh; 1½"(b) coal;
			1'4⅛"(b) coal;
			1⅛" fn. sh. w ¼" coal lens; 109'10¼" 5" coal w ¼" fn. sh. at ½";
			10½" carb. sh; ¾" fn. sh; 2¼" carb. sh; 5⅜" inf. coal; 1¼" carb. sh; 1" m. gy. sh;
M% 6·1 VM% 34·9 FC% 40·4 A% 18·6 Joules/gm. 25000 BTU/lb. 10750 S. 0·56 S.G. 1·389	75·4	Excl.	112'2½" ¾" carb sh; 4"(b) coal; ½" carb. sh;
			1'4¾"(pb) coal w ¼" carb. sh at 2" & 4¼";
			114'7" 6¾" l. gy slts; 2'1" l. gy. sh. → m gy. sh.

N.S. 126

Prox. analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			4'10½" l. gy. slts. → sh. in places;
M% 5·6 VM% 34·8 FC% 39·7 A% 19·9 Joules/gm 24830 BTU/lb. 10680 S. 0·49 S.G. 1·395	94·8		173'2" ¼" carb. sh;
			2'7½"(b) coal w ½" carb sh. at 1½" & 1'3½";
			175'11½" 1" carb. sh. → dk gy sh;
			3'0¾" interbd. l gy. sh. & slts. w. 9" l gy. f. sa at 6";
M% 4·8 VM% 35·3 FC% 38·4 A% 21·5 Joules/gm 24530 BTU/lb. 10550 S 0·43 S.G. 1·409	90·6	Excl Excl	179'1½" ¼" carb sh; 2¼" coal; 1" fn. sh; ¼" carb sh; 1¾"(b) coal; 1" fn. sh; 2½" carb. sh; 4½"(b) coal; ½" fn. sh; 1¾"(b) coal; ¼" carb. sh; 180'10¾" 3½"(b) coal; 2½" carb sh; 2'1½" m gy. sh.

N.S. 127

Prox. analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			3" dk gy. sh;
M% 4·7 VM% 36·9 FC% 38·0 A% 20·4 Joules/gm 25050 BTU/lb. 10780 S. 0·59 S.G. 1·390	99·4	Excl Excl Excl.	189'3½" 5" carb sh; 3¾" coal, 1½" carb. sh; 6"(pb) coal; 1'(pb) carb sh; 6½"(b) coal; ¾" fn. sh; 8¼"(b) coal; ½" carb sh, 11¼"(b) coal,
			192'7¼" ¼" carb sh;
			1'7" l gy sh;
			8½" l gy f. sa;
M% 5·8 VM% 35·5 FC% 41·6 A% 17·1 Joules/gm 25960 BTU/lb. 11170 S. 0·55 S.G. 1·370	100	Excl. Excl.	10½" med. gy sh → slts in pl; 196'0" 1" dk gy sh; 1⅛" carb. sh; 3¾"(b) coal; ¾" fn. sh; 2½" coal; 3¼" carb. sh,
			11"(b) coal → inf. coal in places; 197'9¼" 5" d gy. sh;
			1'10" l. gy. sh. → slts. in places;

N.S. 128

Prox. analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			3'4" l gy sh; 2" m gy sh; 5¼" coal, 4¾" carb sh, ¾" coal; 1⅛" carb. sh; ¾" dk gy sh;
M% 4·8 VM% 36·2 FC% 38·4 A% 20·6 Joules/gm. 25460 BTU/lb. 10950 S. 0·31 S.G. 1·385	100		201'9½" 4⅝" med gy. sh; 7¾"(b) coal; 1¼"(pb) carb sh;
			2'0"(b) coal → inf. coal at btm., w. ¼" fn sh. at 1'5½" & ¼" carb. sh. at 1'9";
M% 3·2 VM% 48·6 F.C% 28·9 A% 19·3 Joules/gm. 26350 BTU/lb. 11330 S. 0·67 S.G. 1·362	100		204'6½" 1¾" carb sh; 3" dk gy sh; 205'1¾" 2¼" carb sh; 7¼" coal; 205'9¾" ¾"(pb) inf coal; ½" carb. sh; ¾" d gy. sh; 10" l gy sh;
M% 4·4 VM% 36·2 F.C% 41·4 A% 18·0 Joules/gm. 25990 BTU/lb. 11180 S. 0·65 S.G. 1·371	100	Excl Excl.	206'10½" 1⅝" carb sh; 3½"(b) coal, ¾" carb sh; ¼" fn. sh; 1¼"(b) coal; ½" carb. sh; 1'4"(b) coal; 6½" carb. sh; 7"(b) coal; 1½" carb sh; 209'0½" 3"(b) coal;
			1'7½" l. gy. sh, slickensided between 4" & 7";

N.S. 129

Prox. analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			3'9½" l gy. sh. → m gy. sh;
M% 4·7 VM% 38·1 FC% 39·3 A% 17·8 Joules/gm 26460 BTU/lb. 11390 S 0·49 S.G. 1·359	87·0		½" carb sh; 6" d gy sh; 171'8¾" 1¾" carb. sh;
			2'3¾"(b) coal w. ¼" carb. sh. at 11";
M% 4·4 VM% 38·9 FC% 40·1 A% 16·6 Joules/gm 26640 BTU/lb. 11460 S 0·47 S.G. 1·359	95·2	Excl	174'7¼" ⅛" fn. sh; ¼" carb. sh; 1½" coal → inf. coal, ¼" carb. sh; 6½" m. gy. sh.; 175'3" 1" carb sh;
			1'0¼"(pb) coal; 176'3¾" ¾" carb. sh; 6½" d gy sh; 176'11½" ⅝" carb. sh;
M% 5·9 VM% 34·8 FC% 40·1 A% 19·2 Joules/gm 25490 BTU/lb. 10970 S. 0·46 S.G. 1·390	94·0	Excl Excl Excl Excl.	1'0(pb) coal w. ¼" fn. sh. at 2" & 8½"; 1" fn sh; 2½" coal; ½ carb sh; 6¾" m gy sh. → d gy. sh; 1" carb sh; 6½ (pb) coal; ½" fn. sh; 1¾" coal; ½" fn sh; 180'5" 6" coal w. ¾" carb. sh. at 4"; 1'6" l. gy. sh.

N.S. 130

Prox. analysis S, Cal. value, S.G.	Recovery percent	Section Sampled	Description
			9" d gy sh; 134'5½" ¼" carb sh; 6"(b) coal w ¼" carb. sh. at 5"; 1" carb sh; 1¼" coal → inf. coal; 1" carb. sh, 135'6¾" 3"(b) coal; ¾" carb. sh; 10½"(pb) coal w. ¼" carb. sh. at 3½";
M% 3·9 VM% 35·3 FC% 34·0 A% 26·8 Joules/gm. 23710 BTU/lb. 10200 S. 0·54 S.G. 1·434	100	Excl. Excl. Excl.	3¾" carb. sh; 6¾"(b) coal; ¾" fn. sh; 5¼"(b) coal; 1⅛ carb. sh; ½" coal; ¾" carb. sh;
M% 4·2 VM% 38·9 FC% 41·8 A% 15·1 Joules/gm. 27720 BTU/lb. 11930 S. 0·43 S.G. 1·332	93·2		8½"(b) coal; 138'11¼" 4¾" carb. sh; 9¾" m gy sh; 140'1¾" ⅛" carb. sh;
M% 4·6 VM% 37·4 F.C% 43·3 A% 14·7 Joules/gm. 27190 BTU/lb. 11700 S. 0·44 S.G. 1·342	100	Excl	11"(b) coal w. ¼" fn sh. at 2¼", 5¾" & 7⅛"; 1" fn sh.; 3¼" carb. sh; 3" m gy sh; ½" carb. sh.; ¼" fn. sh., ¼" carb. sh; 1'0½" coal w. ¼" carb. sh. at 4¾" & 10½"; 142'10½" 6" m gy. sh.; 1'0⅝" l. gy. sh.

FIG. 7

ROSEMOUNT No 4

DIAGRAMS OF SEAMS DETAILS OF CORE RECOVERY AND ANALYSIS

LOWFIELD SEAM

N.S. 19

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
M% 5·1 VM% 37·3 F.C% 34·3 A% 23·3 Joules/gm. 24120 BTU/lb. 10380 S. 0·89 S.G. 1·411	97·4	Excl.	229'4" 2'1½" interbd. l gy sh. & gy. wh. f. sa. w med. gy. slts. lam in btm. 7"; 2" inf. coal; 6½" coal; ½" carb. sh; 5" coal; 2¾" inf. coal; 6¾" carb. sh; 1" fn. sh; 1" carb. sh; 4" l gy waxy sh; 1" carb. sh; 1¼" fn. sh. ← l gy waxy sh; ¾ inf coal; 2¾" carb. sh.; 2'1½" (pb) coal & inf. coal; 2½" carb. sh; 234'10" 2'3" coal; ¼" carb. sh; 1" (b) fn. sh. & carb lam; ½" coal; ¾" carb. sh.; 4" interbd l gy & d gy sh; 7" l gy. slts. w. few l gy. f. sa lam.

N.S. 115

Prox. analysis S, Cal value, SG.	Recovery Percent	Section Sampled	Description
M% 4·8 VM% 36·8 F.C% 41·0 A% 17·4 Joules/gm. 26310 BTU/lb. 11320 S. 0·56 S.G. 1·372	96·7	Excl. Excl.	4'8¼" interbd. l gy sh. & gy. wh. f. sa; 255'3½" 3¾" d gy. sh; 9" coal; 4¾" fn. sh; 1'1½" (pb) coal; 2" carb sh; 3¾" d gy sh; 6" gy wh f. sa w. coal & carb. lents; 11½" (pb) coal w. ¼" carb. sh. at 2"; 259'7¾" 1½" l gy sh; ½" carb sh; 1" coal; 1" carb sh; 7½" m gy sh.

N.S. 21

Prox. analysis S.G.	Recovery Percent	Section Sampled	Description
A% 13·1 S.G. 1·336	100	Excl. Excl. Excl.	1'2½" l gy slts w iron carb from 9" to 1'1½"; 1½" inf. coal; 1" d gy sh; 7½" l gy. slts.; 5½" gy wh. f. sa; 313'2½" ½" (b) coal; 1½" carb sh; 5¾" (b) coal; ¾" m gy sh; ¼" coal; 1" carb sh; 2¼ fn sh., ⅛" carb. sh; 11¾" (pb) coal w. ½" d gy. sh. at 1"; 2½" carb sh; 3" coal; 6¼" carb. sh.; 1'4" (b) coal w. 1" carb. sh. at 7"; 317'4½" 1½" d gy sh; 1'0" m. gy. slts ← sh.

N.S. 121

Prox. analysis S.G.	Recovery Percent	Section Sampled	Description
M% 6·4 VM% 37·6 F.C% 43·1 A% 13·9 Joules/gm. 27340 BTU/lb. 11760 S. 0·51 S.G. 1·346	93·7	Excl. Excl.	30' l gy. f. sa w. few thin beds of l gy sh; 2½" l gy sh; ½" carb. sh; 4" d gy. sh; ¾" med gy. sh; 317'6" 4¼" (pb) carb. sh; 3¼" (b) coal; 4" fn. sh; ¼" carb. sh.; 1'2¾" (pb) coal ← inf. coal in places; 1¾" carb. sh; 2" l gy. sh.; 1'2¾" interbd. l gy f sa & l gy sh; 6" l gy. sh.; 2¾" med. gy sh; 1'1¼" (pb) coal ← inf. coal in places; 323'1½" ½" carb sh.; 1¼" fn sh.; ¼" carb. sh; 2'2" l gy sh.

LANEFIELD No 5 SEAM UNDERGROUND SECTIONS

'B'

Section Sampled	Description
5'3"	Roof: sh.; 1'0" coal; 3" carb. sh.; 1'0" coal; 6" dk gy. sh.; 2'6" coal w at least 4 sh. bands each about ⅛" thick; Floor: sh.

'C'

Prox. analysis S.G.	Section Sampled	Description
M% 4·0 V.M% 38·3 F.C% 42·7 A% 15·0 Joules/gm 27360 BTU/lb. 11780 S. 0·58 S.G. 1·339 M% 4·8 V.M% 35·2 F.C% 38·3 A% 21·7 Joules/gm 24380 BTU/lb. 10490 S. 0·50 S.G. 1·400	4'2"	3" carb. sh; 4" inf. coal; 2" gy. sh. (varies); 1'3" coal, inf. coal in places in top 3"; 1" l gy sh. w. carb. lam.; 5½" coal; 3½" carb sh, ½" fn sh; 4" coal; 1½" gy sh. (varies 1"-4"); 1'1" coal w. ½" gy at 3", 5" & 11"; 1½" gy sh; 1'0" coal w ½" gy sh. at 6" & 8";

'D'

Section Sampled	Description
3'2½"	Roof: l gy. sh ← med gy sh in btm. 9"; 2" coal; 6" carb. sh.; 6" coal; 1" carb sh; 3¾" bluey; 6¾" coal; 1" fn. sh; 1'8" coal; Floor: sh.

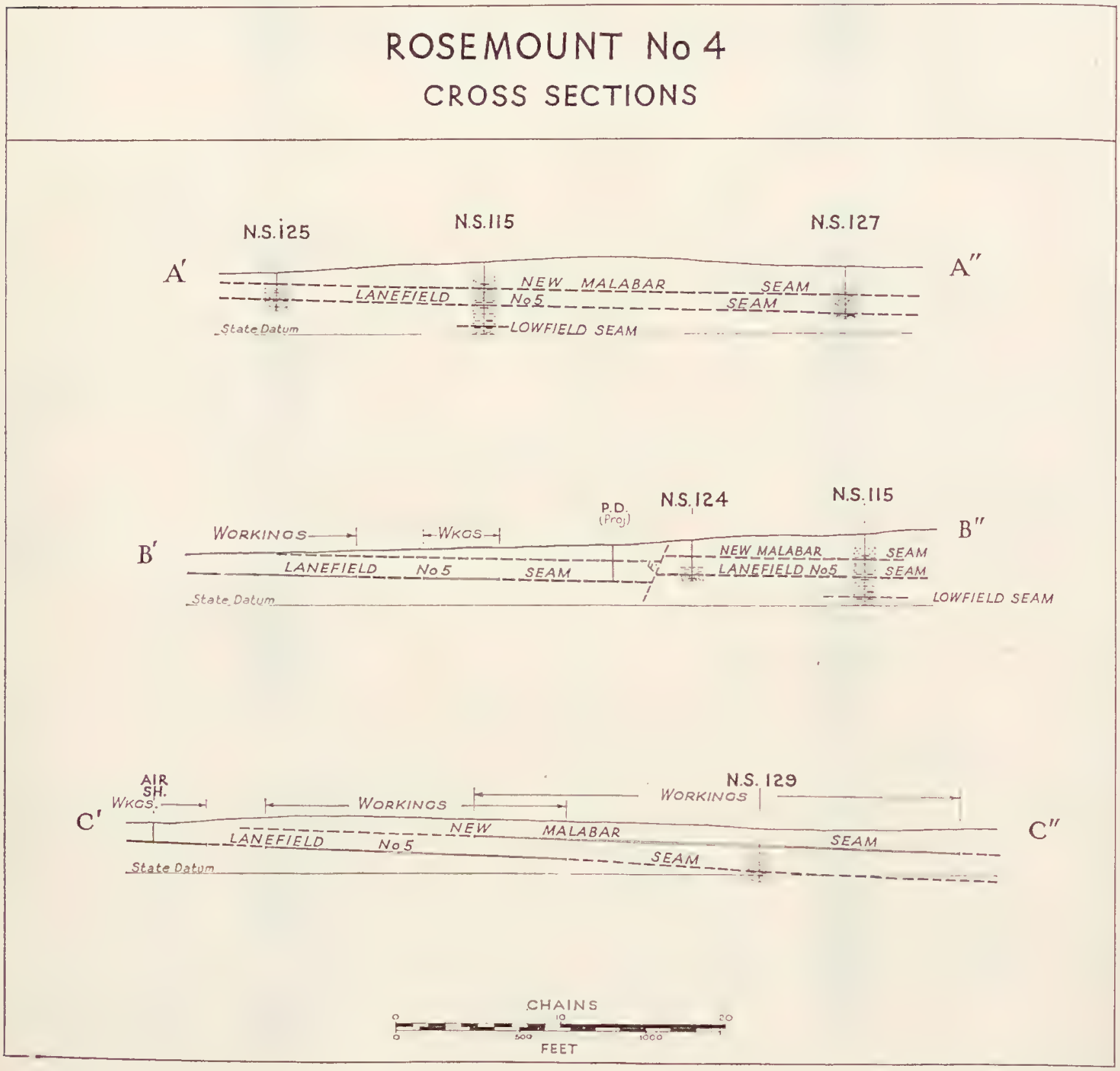
'E'

Section Sampled	Description
3'7" 2'0"	Roof: gy. sh; 11" coal; 6" dk. gy. sh. ← carb. sh; 5" coal; 1" fn. sh; 1'8" coal w ½" lent. fn. sh at 9"; 11" gy. sh; 1½" dk gy sh; 7" coal; 1" gy. sh.; 3" coal; 3' gy. sh.; 10" coal; Floor: sh.

tons. Seam thickness is 4 ft. 4½ in. including 3 ft. 8½ in. of coal. Weighted average ash content is 16·0 per cent. These two areas of measured reserves in the New Malabar seam are separated by a wide corridor in which the "tops" and "bottoms" of the seam are separated by several feet of shale.

The measured reserves established in the **Lanefield No. 5 seam** also lie in two distinct areas. (i.) To the north of the Bottom seam workings, the reserve area, embracing boreholes, N.S. 114-115, N.S. 121 and N.S. 124, extends over 46½ acres. Seam thickness varies from 4 ft. 3 in. in borehole N.S. 121 (where only the "tops" of the seam can be worked) to 7 ft. 5 in. in borehole N.S. 114. Within the area defined, the average thickness of coal in the working section is 4 ft. 5 in. Measured reserves with a weighted average ash content of 19·8 per cent. amount to 350,000 tons. (ii.) To the dip, south of the present workings, the area of measured reserves extends over 36 acres and embraces boreholes N.S. 128-130. Seam thickness varies from 6 ft. 7½ in. to 8 ft. 8 in., the average thickness of coal being 5 ft. 6 in. Measured reserves with a weighted average ash content of 18·1 per cent. total 330,000 tons. Because of the high proportion of stone to coal, the Lanefield No. 5 seam section in most parts of this southern area closely approaches the limit of workability. A more attractive working section in this regard could be obtained by using the 6-9 in. shale bed which lies above the bottom foot of coal in boreholes N.S. 128-130 as the pavement. Seam

FIG. 8



thickness then would still be in excess of 5 ft., ranging from 5 ft. 9 in. to 6 ft. 9 in. with an average thickness of coal of 4 ft. 6 in. With this arrangement, measured reserves in this southern area would be reduced to 270,000 tons.

The coal from both the New Malabar and Lanefield No. 5 seams is of high-volatile bituminous rank. Dry, mineral-matter-free fixed carbon varies from 50·56 to 54·93 per cent., while calorific value, calculated on a moist, mineral-matter-free basis, ranges from 13,140 to 14,330 B.Th.U. per lb.

CONCLUSIONS

As a result of the diamond drilling programme in the Rosemount No. 4 mine area, measured reserves were established in the following seams:—

	Tons
Top or New Malabar seam—	
Northern area	90,000
Southern area	120,000
Bottom or Lanefield No. 5 seam—	
Northern area	350,000
Southern area	330,000
Total	890,000

Because of the lease conditions governing mining practice, the tonnage of coal produced from these reserves will be somewhat less than the above estimate. This will be so mainly in the southern reserve areas of both the New Malabar and Lanefield No. 5 seams for in Portion 357A, east of the main tunnel, and also in Portion 357B, pillar extraction is prohibited, the coal won from the first and second workings being restricted to 60 per cent. Extractable measured reserves in this part of the mine area are estimated to be—

New Malabar seam—70,000 tons;

Lanefield No. 5 seam—300,000 or 240,000 tons (depending, as previously discussed, on whether or not the full section is exploited).

Maximum extractable reserves for the whole of the mine area are therefore 810,000 tons. Of this figure, however, only 45 per cent. is available for immediate exploitation—the 300,000 tons in the Lanefield No. 5 seam to the south and another 70,000 tons in the same seam to the north. The remaining reserves in both the New Malabar and Lanefield No. 5 seams lie beyond the major fault which was encountered but not penetrated in the Top seam workings. Beyond this fault, the seams are upthrown to the north-east about 30 ft. If the measured reserves in this part of the mine area are to be won from Rosemount No. 4 Colliery, a considerable amount of cross-measure drifting will be necessary. This applies particularly to the 90,000 tons of coal in the New Malabar seam in the northern reserve area. On the other hand, this coal could be won readily from Oakleigh Colliery as an adjacent area in this seam within C.M.L. No. 317 has already been subleased to Oakleigh Colliery Coy and a fair proportion of the coal therein extracted.

REFERENCES

CAMERON, J. B., 1956: Coal resources—Rosewood–Walloon coalfield (Lanefield No. 5 mine area). *Qld Govt Min. J., 57,* 457-459.

————, 1959: Coal resources—Rosewood–Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

————, 1961: Coal resources—Rosewood–Walloon coalfield (Glencoe mine area). *Qld Govt Min. J., 62,* 93-102.

REID, J. H., 1922: Geology of the Walloon–Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

————, 1927: Coal mining and boring operations, etc., Rosewood. *Qld Govt Min. J., 28,* 4-8.

29th July, 1960.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (OAKLEIGH MINE AREA—SUPPLEMENT)

By J. B. CAMERON

SUMMARY

This report records the results of drilling designed to raise the category of reserves indicated in the Oakleigh Airshaft, United No. 8 Bottom and Lowfield seams by earlier drilling.

Three holes were drilled, the aggregate footage being 956 ft. 7 in.

As a result, reserves in these seams in the mine area may now be stated as:—

Oakleigh Air shaft seam—Measured 505,000 *tons;*

United No. 8 Bottom seam—Indicated 275,000 *tons;*

Lowfield seam—Indicated 180,000 *tons.*

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

From March, 1955, to January, 1956, exploratory diamond drilling was carried out by the Department of Mines in the Oakleigh mine area. Although only limited reserves were established in the New Malabar seam, then the sole working seam and main target of the drilling programme, the existence of considerable reserves in three underlying seams was indicated (Cameron, 1961). The reserves in the topmost of these seams, the Oakleigh Airshaft seam, were so disposed that they could be readily worked from the existing pithead of Oakleigh No. 3 Colliery and so in 1957 the access tunnel was extended to intersect this seam a further 100 ft. below. Since then, considerable development has been carried out in the Oakleigh Airshaft seam in preparation for active exploitation when the New Malabar seam is worked out.

Following the efforts made by Oakleigh Colliery Coy, a supplementary diamond drilling programme was implemented by the Department from December, 1958, to February, 1959, in an endeavour to raise the status of the reserves in the Oakleigh Airshaft seam from indicated to measured. Three boreholes, N.S. 147-149, were drilled by the Sullivan 22 HD No. 1 plant, the aggregate footage being 956 ft. 7 in. Overall core recovery was 96·7 per cent. Although a jig-type washing plant was installed at Oakleigh Colliery in 1958, the procedure followed in the sampling and analysis of workable coal sections was the same as that adopted for the earlier drilling programme. Thus a uniform basis for the assessment of coal resources was maintained.

Accompanying the report are the following plans, sections and diagrams:—

(*a*) Plan showing positions of boreholes, extent of mine workings in the Oakleigh Airshaft seam, surface contours at 20 ft. intervals and underground levels on State Datum, and boundary of measured reserves—fig. 1.

(*b*) Generalised bore sections—fig. 2.

(*c*) Diagrams of seams showing sections analysed and results—

Oakleigh Airshaft seam—fig. 3;

United No. 8 Bottom seam—fig. 4

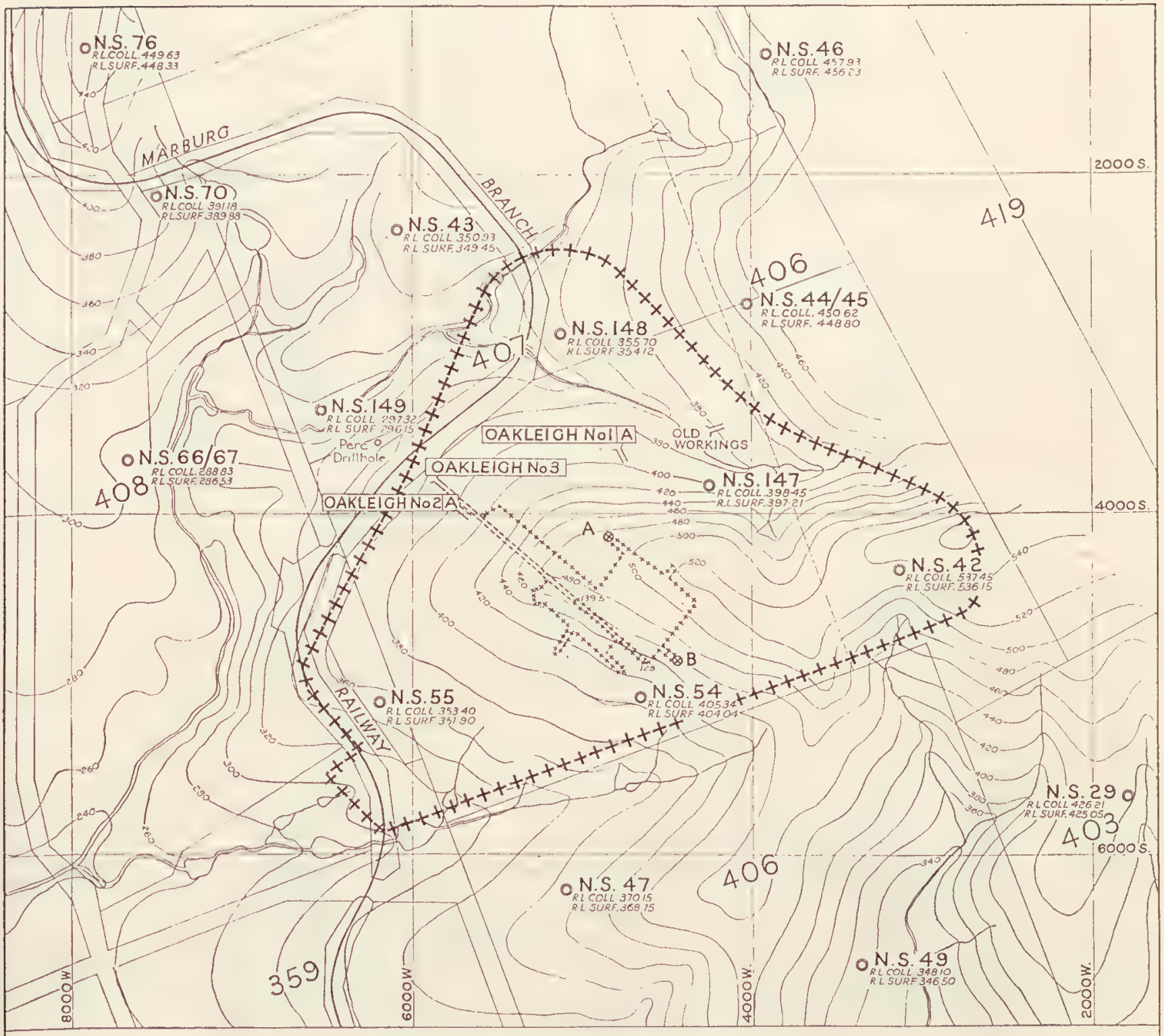
Lowfield seam—fig. 5.

SUBSURFACE GEOLOGY

The **Oakleigh Nos. 1-4 seams** and the **New Malabar seam** were cored only in borehole N.S. 147 (see fig. 2); in the other boreholes, coring was not commenced until within 40 ft. of the Oakleigh Airshaft seam.

The initial diamond drilling programme in the Oakleigh mine area showed that the **Oakleigh Airshaft seam** comprises three distinct sections of coal; the topmost coal, up to 18 in. thick, lying usually about 6 ft. above the rest of the seam which is split into 3-4 ft. of "tops" and 18-24 in. of "bottoms" by a shale band varying in thickness from a few inches to several feet. Although over the greater part of the area tested only the "tops" of the seam present a workable section, in the vicinity of Oakleigh No. 3 Colliery airshaft, where the seam was first encountered, both the "tops" and " bottoms" of the seam can be worked together. As a result of the supplementary drilling programme and recent colliery development, the area within which this thicker seam section can be exploited can now be more accurately delineated. Its south-western limit is clearly evident in the Oakleigh Airshaft seam workings; in the south only the "tops" of the seam were worked but in the more advanced places to the north-east the working section is 7 ft. thick and includes both the "tops" and "bottoms", the shale interbed being only a few inches thick. To the north and east, the area can be extended to include boreholes N.S. 147-148 where the shale between the two coal sections is 1 ft. 2½ in. and 1 ft. 7½ in. thick, respectively. Beyond this, however, rapid growth of this stone can be expected for in boreholes N.S. 149 and N.S. 43-44 it varies in thickness from 2 to 7 ft. Furthermore, in

FIG. 1



DEPARTMENT OF MINES , QUEENSLAND

OAKLEIGH MINE AREA—SUPPLEMENT
ROSEWOOD–WALLOON COALFIELD

Showing boreholes, mine workings, topography and boundary of measured reserves

To accompany report by J.B. Cameron, B.Sc.App.(Geol), Geologist

Topographic survey by Ewan Cowley, Asst. Surveyor

SCALE OF CHAINS

10 0 10

SURVEY DATA

Twenty chain grid on True North. Origin of Grid: Perry's Nob Trig. Station
Elevations in feet on State Datum

EXPLANATION

Colliery (working) [NEATH] *Colliery (aband)* [NEATH A]
Shaft *Diamond drillhole* N.S.19
Adit *Surface contour* 300
Underground level 129 *Seam section measured* A
Limits of mine workings in Oakleigh Airshaft Seam
Limits of measured reserves, Oakleigh Airshaft Seam

this area the "tops" of the seam alone do not present a workable section because of the presence of a carbonaceous shale or "bluey" band nearly 1 ft. thick. Detailed seam sections of the Oakleigh Airshaft seam together with analytical results are shown in fig. 3.

Drilling was continued in all three boreholes N.S. 147-149 to test the underlying United No. 8 Bottom and Lowfield seams (see fig. 2) in which indicated reserves were established by the initial programme. In the **United No. 8 Bottom seam** workable coal was penetrated only in borehole N.S. 149 (see fig. 4); in the other two boreholes the proportion of coal to stone is considered to fall just short of the limit of workability. Disappointing sections were also penetrated in the **Lowfield seam,** the only workable coal being a 4 ft. 2 in. section in borehole N.S. 149 (see fig. 5). This coal represents the lower part of the Lowfield seam, being separated from the upper part with its characteristic band of waxy, fawn shale by over 1 ft. of grey shale. In boreholes N.S. 147-148 this splitting of the Lowfield seam is much more pronounced, there being 6-15 ft. of shale and sandstone between the two sections of the seam in that area.

FIG. 2

OAKLEIGH — SUPPLEMENT

GENERALISED BORE SECTIONS

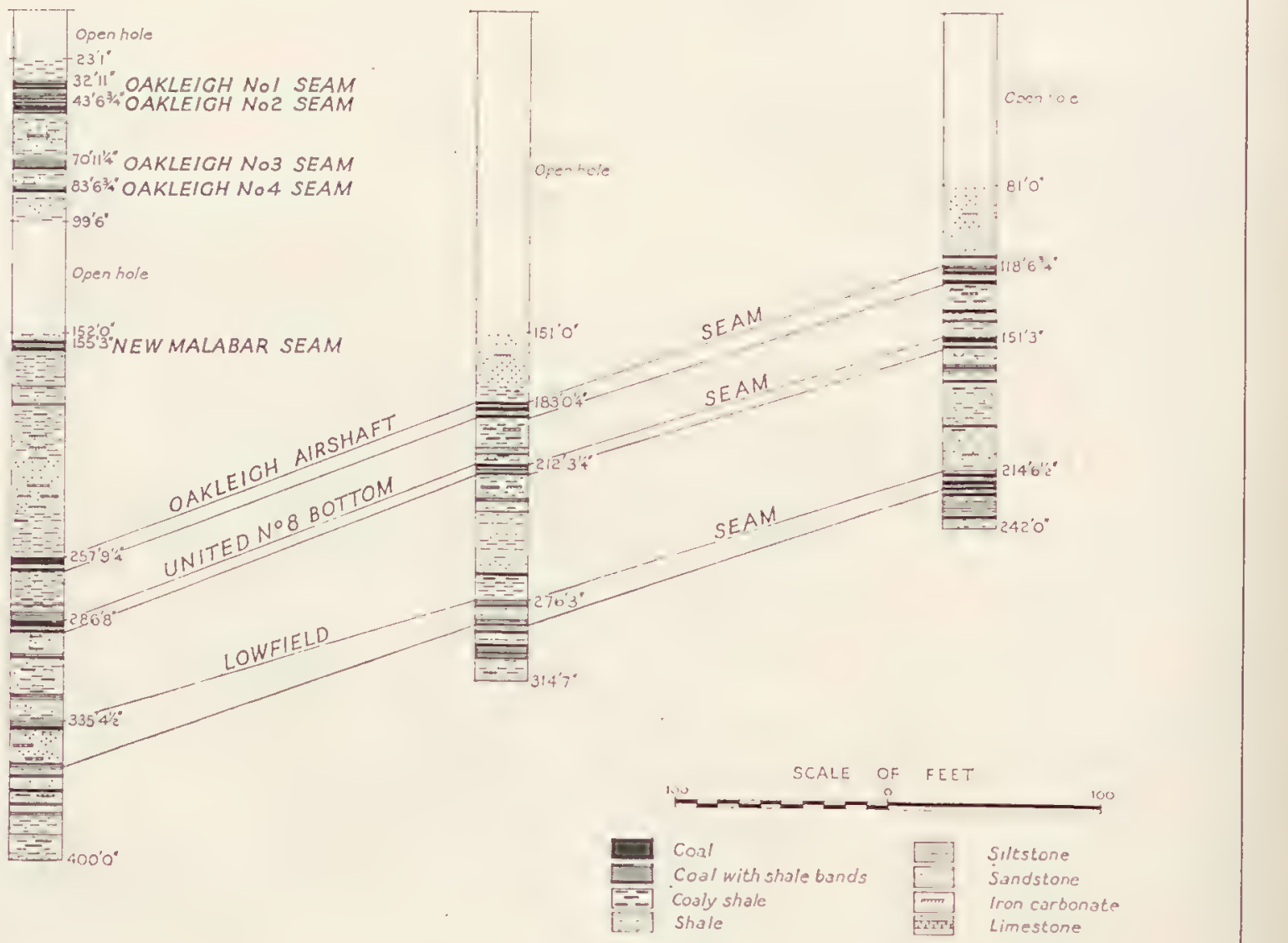


FIG. 3

OAKLEIGH — SUPPLEMENT

DIAGRAMS OF OAKLEIGH AIRSHAFT SEAM

DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 43

Prox. analysis S, Cal value, SG.		Recovery Percent	Section Sampled	Description
M%	4·0			1'2" l gy sh; 2½" carb sh; 2¾" fn sh;
VM%	36·1			139'5¾" 2" carb sh, ¾(p b) coal; 1½" ibd. carb sh. & fn sh.;
FC%	38·4		Excl.	9½"(p b) coal w. ¼" m gy sh. at 5½";
A%	21·5	100	Excl.	11¾" carb sh.;
Joules/gm	24490			1" coal; ½" fn sh; ½" coaly sh;
BTU/lb	10540		Excl	2½" b. coal, ¾" carb sh, 1" coal,
S.	0·62			1" dk gy sh, 4" coal,
SG.	1·42			1½(b) fn sh, ¼" carb sh
			Excl.	8½"(p b) coal w two ¼" fn sh bds at 3½" & 4½"
				143'6½" 1" carb sh (cent), ¾" inf. coal,
				3" l gy sh.; 1½"(b) coal;
				5'7½" ibd. l gy sh & slts;
				6¾" ibd. fn. & m gy. sh. w. i. carb. in top 4";
				8½" carb. sh. → coaly sh. w. fn. sh. lam.
				150'9¾" in btm 1½";
				1'5½" coal & inf. coal w. 1" fn. sh. at 3",
				three ¼" fn. sh. bds in top 4" & ¼ fn. sh at 10½";
				152'3¼" 2" carb sh;
				3¾" l gy sh; ½"(b) coaly sh;
				8½"(p b) m gy sh.

N.S. 44

Prox. analysis, S, Cal value, SG.		Recovery Percent	Section Sampled	Description
				5" m gy sh. → d gy sh;
				1½" fawn sh;
				9½" carb. sh.;
				½" l gy sh; ¼" carb sh; ½" coal, 2¼" m g sh.
				294'10" 1½"(b) coal; ½" carb sh;
M%	4·5			1'3¼"(p b) coal w few ¼" carb sh bands
VM%	38·1			in btm 6";
FC%	41·7			¾" carb sh;
A%	15·7	97·3		8¾" m gy. → d gy. sh.;
Joules/gm	26730		Excl.	
BTU/lb.	11500			9"(p b) coal;
S.	0·57			297'10¾"
SG.	1·36			4'5¼" l gy sh. → slts in places w. 4" d gy
				sh. at 2'8";
				302'6" 2" d gy sh;
				1'5¼" coal & inf. coal w. two ½" gy. sh.
				bands at 4" & 10½";
				303'11¼" 2¼" carb. sh.; 3" l gy sh;
				5" d gy. sh.

N.S. 147

M%	5·4			257'9¾" 8" dk. gy. sh.;
VM%	37·2			2'1¼"(p b) coal w ⅛" carb. sh. at ½" & l gy sh
FC%	39·2			lam. at 1'3", grades to inf. coal 11" → 1'1½";
A%	18·2	100	Excl	¾" carb sh, ¼" dk gy sh,
Joules/gm	25410			3½"(p b) coal;
BTU/lb.	10930		Excl.	½" carb. sh., ¼" dk gy sh; ½"(b) inf. coal;
S.	0·51			261'1½" 2½"(p b) coal; 1½" dk gy sh;
SG.	1·377			3¾" l gy sh → slts in mid, ¾" carb sh,
				1" coal, ¼" med gy sh, 2" inf. coal, ½" med gy
M%	5·9			262'4" sh, 1" coal, 3¼" med gy sh,
VM%	35·2			2¼" coal, ¾" d gy sh, 2¼" coal,
FC%	40·1		Excl.	1" med gy sh, 3" coal,
A%	18·8	100		¼" dk gy sh.;
Joules/gm.	24710			5"(p b) coal, inf. in top 1½";
BTU/lb.	10630			263'11"
S.	0·48			1'1" dk gy. sh..
SG.	1·393			

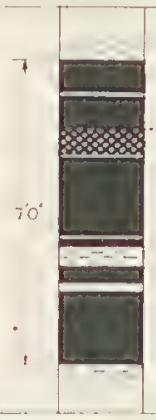
N.S. 148

				183'0¼" 10" d gy sh;
				8¾"(p b) coal, w. l gy. sh. lents. in top 2";
			Excl.	1" m gy sh; ¼" carb sh; 2¼" coal, ½" carb. sh;
M%	5·7			7¼"(p b) coal w. l gy. sh. lam. at 2¼";
VM%	37·6		Excl.	7"(p b) carb sh;
FC%	41·8		Excl	1¾" coal, ¼" d gy sh, ½" fn sh;
A%	15·1	86·8		2½" coal, ¾" carb sh, 1½" coal,
Joules/gm	26780		Excl.	¾" carb sh, 2¼" coal, 1" carb sh;
BTU/lb	11520			11½"(p b) coal w fn. sh lam at 5½";
S.	0·68			187'10¾" ¼" d gy sh, 2" m gy sh, ¼" carb sh,
SG.	1·350			1¼" coal, ¼" carb sh, 2¼" dk gy sh;
				1" or sh.,
M%	6·0			8½" med gy. sh,
VM%	36·6			3¾" d gy sh,
FC%	40·3		Excl.	189'6½" 1¼" coal, ½" carb sh, 1"(b) coal, ¾" carb sh,
A%	17·1	100	Excl.	5½"(b) coal,
Joules/gm.	25640			½" carb sh;
BTU/lb.	11030			7" coal;
S	0·47			¾" carb. sh., 1¼" d gy. sh;
SG.	1·374			191'0¼" 2¾" m gy sh; 2¾" carb sh;
				1¼" m gy. sh.; 1½" d gy sh.

N.S. 149

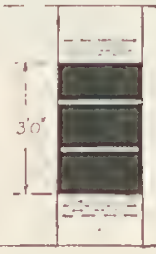
				8½" dk gy sh..
				2" carb sh; 3" br. waxy sh,
				2½" carb sh;
				½"(b) coal; 1¼"(p b) carb sh; ½"(b) coal;
				2" m gy sh. w i carb pods, 2"(b) inf coal;
M%	5·7			119'4½" 3½" carb sh; 1¼" inf. coal; ½" carb. sh;
VM%	35·4			4¼" coal;
FC%	35·9		Excl	10¼" carb sh;
A%	23·0	100		11" coal;
Joules/gm	23300			1¼" coaly sh; 1" dk gy sh;
BTU/lb	10020		Excl	8½" coal;
S.	0·63			¾" carb sh; 2½" coal;
SG.	1·410		Excl	122'0½" 3" m gy sh,
				8½" l gy f sa;
				3" l gy slts;
				4" l gy sh;
				5½" m gy sh;
M%	6·5			124'4½" 2½" inf coal; 1" carb sh,
VM%	36·3		Excl	3½"(p b) coal; 1¼" carb sh. w. few clay lents.
FC%	40·6		Excl	6½"(p) coal,
A%	16·6	75·0		½" carb sh; 2"(p b) coal; ¼" dk gy sh;
Joules/gm.	25690			2½"(p b) inf. coal;
BTU/lb	11050			127'0½" 3¼" d gy sh; sh;
S	0·49			1¼" carb. sh., ¼" inf. coal, ½" carb sh, ½" m gy.
SG.	1·364			1'4¼" m gy. slts. → sh.

SEAM SECTION 'A'



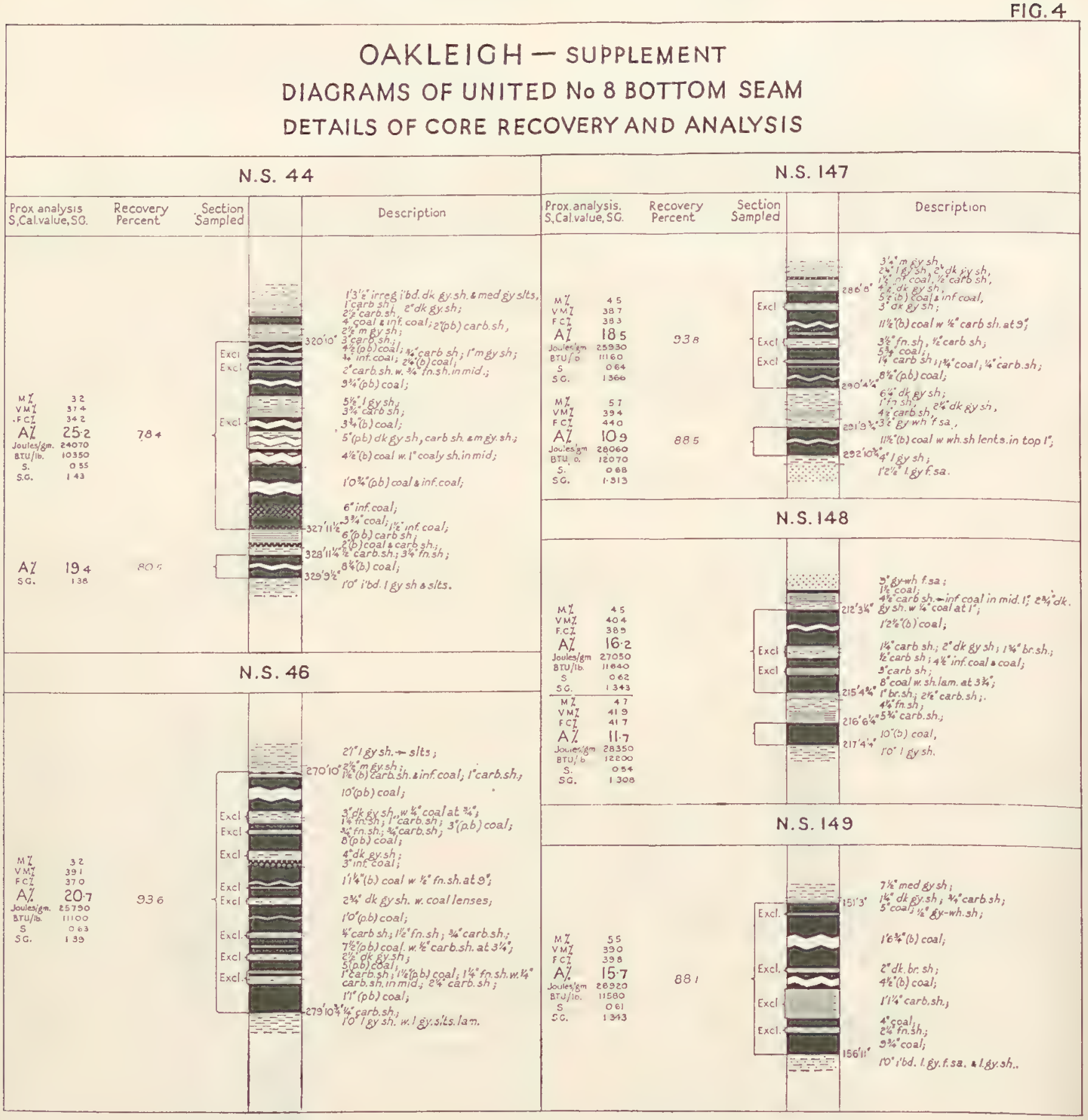
Roof: sh;
3" coal;
1" gy. sh.;
9" coal, inf. in places from 1½" - 6";
7½" bluey;
½" l. gy. sh.;
1'10" coal;
½" carb sh; 2½" coal;
5" gy. sh., dk gy in top 1";
5" coal w two ¼" sh. bands;
2" dk. gy. sh;
1'8" coal w. ¼" sh. bands at 1½", 4", 1'0" & 1'3";
Floor: sh.

SEAM SECTION 'B'



Roof: sh.
10½" coal;
1" gy. wh. sh;
2'0½" coal w. 1" carb. sh. at 1'0";
Floor: sh.

FIG. 4


OAKLEIGH — SUPPLEMENT
DIAGRAMS OF UNITED No 8 BOTTOM SEAM
DETAILS OF CORE RECOVERY AND ANALYSIS
N.S. 44
Prox analysis S,Cal.value,SG.
Recovery Percent
Section Sampled
Description
M% 3·2
VM% 37·4
FC% 34·2
A% 25·2
Joules/gm. 24070
BTU/lb. 10350
S. 0·55
S.G. 1·43
78·4
A% 19·4
S.G. 1·38
80·5
320'10" 1'3½" irreg i'bd. dk gy.sh. & med gy slts, 1" carb sh; 2" dk gy.sh; 2½ carb.sh, 4" coal & inf. coal; 2"(pb) carb.sh, 2½ m gy sh; 3" carb sh.; 4½(pb) coal; ¾" carb sh; 1" m gy sh; ¾ inf. coal; 2¼"(b) coal; 2" carb.sh. w. ¾" fn.sh. in mid.; 9¾"(pb) coal;
5½" l gy sh; 3¾" carb sh; 3¼"(b) coal; 5"(pb) dk gy sh, carb sh. & m gy. sh.; 4½"(b) coal w. 1" coaly sh. in mid; 1'0¾"(pb) coal & inf. coal; 6" inf. coal;
327'11½" 3¾" coal; 1½" inf. coal; 6"(pb) carb sh; 2"(b) coal & carb sh.;
328'11¼" ½" carb.sh.; 3¾" fn.sh; 8¾"(b) coal;
329'9½" 1'0" i'bd. l gy sh & slts.
N.S. 46
M% 3·2
VM% 39·1
FC% 37·0
A% 20·7
Joules/gm. 25790
BTU/lb. 11100
S 0·63
S.G. 1·39
93·6
270'10" 21" l gy sh. → slts; 2½" m gy sh; 1½"(b) carb.sh. & inf. coal; 1" carb.sh.; 10"(pb) coal;
3" dk gy sh. w ¼" coal at ¾"; 1¼ fn.sh; 1" carb.sh; 3"(p.b) coal; ¾" fn.sh; ¾" carb.sh; 8"(p.b) coal;
4" dk gy.sh; 3" inf. coal; 1'1¼"(b) coal w ½" fn.sh. at 9"; 2¾" dk gy sh. w. coal lenses; 1'0"(p.b) coal; ¼" carb sh; 1½" fn.sh; ¾" carb.sh.; 7½"(pb) coal. w. ½" carb.sh. at 3¼"; 2½" dk gy.sh; 5"(pb) coal; 1" carb.sh; 1½"(pb) coal; 1¼" fn.sh. w. ¼" carb.sh. in mid.; 2¼" carb.sh; 1'1" (pb) coal;
279'10¾" ¼" carb.sh.; 1'0" l gy sh. w. l gy. slts. lam.
N.S. 147
Prox. analysis. S,Cal.value, SG.
Recovery Percent
Section Sampled
Description
M% 4·5
VM% 38·7
FC% 38·3
A% 18·5
Joules/gm 25930
BTU/lb 11160
S 0·64
S.G. 1·366
93·8
M% 5·7
VM% 39·4
FC% 44·0
A% 10·9
Joules/gm 28060
BTU/lb 12070
S. 0·68
S.G. 1·313
88·5
286'8" 3¼" m gy sh; 2¾" l gy sh; 2" dk gy sh; 1½" inf coal; ½" carb sh; 4½" dk gy sh; 5½"(b) coal & inf coal; 3" dk gy sh; 11½"(b) coal w ¼" carb sh. at 9"; 3½" fn.sh; ½" carb sh; 5¾" coal; 1¼" carb sh; 1¾" coal; ¼" carb.sh; 8½"(p.b) coal;
290'4¼" 6¼" dk gy sh; 1" fn sh; 4½" carb sh; 2¾" dk gy sh;
291'9¾" 3½" gy wh f sa.; 11½"(b) coal w wh.sh lents. in top 1";
292'10¾" 4" l gy sh; 1'2½" l.gy f.sa.
N.S. 148
M% 4·5
VM% 40·4
F.C% 38·9
A% 16·2
Joules/gm 27050
BTU/lb. 11640
S 0·62
S.G. 1·343
M% 4·7
VM% 41·9
F.C% 41·7
A% 11·7
Joules/gm 28350
BTU/lb 12200
S. 0·54
S.G. 1·308
5" gy-wh f.sa; 1½" coal; 4½" carb sh. → inf coal in mid. 1"; 2¾" dk.
212'3¾" gy sh. w ¼" coal at 1"; 1'2½"(b) coal;
1¾" carb sh.; 2" dk gy sh; 1¾" br.sh.; ½" carb sh; 4½" inf. coal & coal; 3" carb sh; 8" coal w. sh.lam. at 3¾";
215'4¾" 1" br.sh; 2½" carb.sh; 4¼" fn.sh;
216'6¼" 5¾" carb.sh.;
217'4¼" 10"(b) coal, 1'0" l gy sh.
N.S. 149
M% 5·5
VM% 39·0
F.C% 39·8
A% 15·7
Joules/gm 28920
BTU/lb. 11580
S 0·61
S.G. 1·343
88·1
151'3" 7½" med gy sh; 1¼" dk gy.sh; ¾" carb.sh; 5" coal; ½" gy-wh.sh; 1'6¾"(b) coal;
2" dk. br. sh; 4½"(b) coal; 1'1¼" carb.sh.; 4" coal; 2¼ fn.sh; 9¾" coal;
156'11" 1'0" i'bd. l.gy.f.sa. & l.gy.sh..
Excl

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings)—

(*a*) measured reserves—up to 12½ chains;

(*b*) indicated reserves—from 12½ to 20 chains.

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

These definitions of measured and indicated coal are the same as those employed at the time of the initial drilling programme in the Oakleigh mine area except that a specific upper limit of 20 chains is now placed on the distance between observation points used in the estimation of indicated reserves. This has been done to improve the reliability of indicated coal which must be computed partly from definite measurements and partly from projection of available data

for distances consistent with the geological evidence. In view of the rapid, lateral changes which occur in the geological character of the coal seams in the Rosewood Coalfield, the assessment of indicated reserves is not considered advisable in areas where the points of observation are more than 20 chains apart. The projection of borehole data over greater distances can be quite misleading, as is well illustrated by the results of borehole N.S. 149 where in the Lowfield seam the thickness of minable coal penetrated was found to be much less than would be expected from interpolation of data obtained earlier from boreholes N.S. 43 and N.S. 66-67.

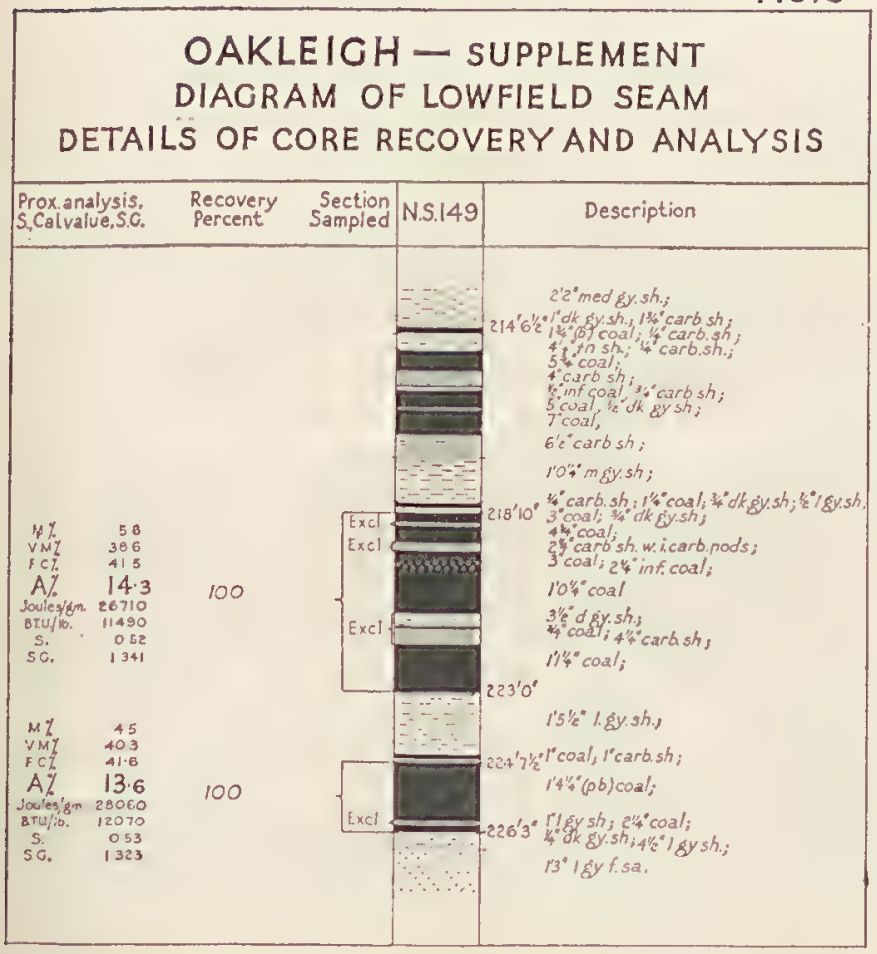
As a result of the supplementary diamond drilling programme and the developmental work carried out by the colliery management, the reserves of coal previously established in the **Oakleigh Airshaft seam** have been raised in status from indicated to measured and the tonnage increased from 325,000 to 505,000 tons. These measured reserves with a weighted average ash content of 18·1 per cent. extend over an area of 70½ acres embracing boreholes N.S. 42, N.S. 54-55 and N.S. 147-148 (see fig. 1). It is estimated that 275,000 tons of this coal (weighted average ash content—19.2 per cent.) will be won from an area of 30 acres around boreholes N.S. 147-148 to the north and north-east of the present workings; the seam section there which includes both the "tops" and "bottoms" is 7-8 ft. thick, the average thickness of coal being 5 ft. 5 in. The remaining reserves of 230,000 tons (weighted average ash content—16·9 per cent.) lie in an area where only the "tops" of the seam can be worked, that is, in the vicinity of boreholes N.S. 42 and N.S. 54-55. Seam thickness there varies from 3 ft. to 4 ft. 9½ in., the average thickness of coal being 3 ft. 4½ in.

Because of the excessive distance between observation points, the reserves of coal established in both the United No. 8 Bottom and Lowfield seams by the initial drilling programme cannot now be classified as indicated. However, borehole N.S. 149 drilled during the supplementary programme is so sited that a reassessment of indicated coal in terms of the present definition can be made in the areas previously defined (Cameron, 1961, fig. 2).

In the **United No. 8 Bottom seam** in borehole N.S. 149 the thickness of minable coal recovered is 5½ in. less than would be expected from interpolation of data from boreholes N.S. 43 and N.S. 66-67. As this discrepancy is most likely due to loss of coal during drilling, indicated reserves are again estimated to be 275,000 tons.

In the case of the **Lowfield seam,** the thickness of minable coal in borehole N.S. 149 is only 3 ft. 2½in., 23 in. less than would be expected from interpolation of data previously available. This major discrepancy results mainly from the splitting of the Lowfield seam previously discussed and deterioration of the top coal. Available geological evidence suggests, however, that these unfavourable conditions do not extend much further north than borehole N.S. 149 so that the full Lowfield seam section can be exploited over the greater part of the area defined. In consequence, indicated reserves are estimated to be 180,000 tons.

FIG. 5


OAKLEIGH — SUPPLEMENT
DIAGRAM OF LOWFIELD SEAM
DETAILS OF CORE RECOVERY AND ANALYSIS
Prox. analysis, S, Cal value, S.G.
Recovery Percent
Section Sampled
N.S.149
Description
M% 5·8
VM% 38·6
FC% 41·5
A% 14·3
Joules/gm. 26710
BTU/lb. 11490
S. 0·52
S.G. 1·341
100
Excl
Excl
Excl
M% 4·5
VM% 40·3
FC% 41·6
A% 13·6
Joules/gm 28060
BTU/lb. 12070
S. 0·53
S.G. 1·323
100
Excl
2'2" med gy.sh.;
214'6½" 1" dk gy.sh.; 1¾" carb.sh; 1¾" (6") coal; ½" carb.sh; 4" gn sh.; ¼" carb.sh.; 5¾" coal; 4" carb sh; ½" inf coal; 3¼" carb sh; 5" coal, ½" dk gy sh; 7" coal,
6'2" carb sh;
1'0¾" m gy.sh;
218'10" ¼" carb.sh; 1¼" coal; ¾" dk gy.sh; ½" l gy.sh. 3" coal; ¾" dk gy.sh; 4¾" coal; 2⅝" carb sh. w. l. carb. nods; 3" coal; 2¼" inf. coal;
1'0¾" coal
3½" d gy.sh.; ¾" coal; 4¾" carb.sh;
1'1¼" coal;
223'0"
1'5½" l.gy.sh.;
224'7½" 1" coal, 1" carb.sh;
1'4¾" (pb) coal;
226'3" 1' l gy sh; 2¼" coal; ¼ dk gy.sh; 4½" l gy sh.;
13" l gy f.sa.

CONCLUSIONS

As a result of the supplementary diamond drilling programme in the Oakleigh mine area and developmental work carried out by the colliery management, measured reserves totalling 505,000 tons with a weighted average ash content of 18·1 per cent. have been established in the Oakleigh Airshaft seam. These reserves replace the 325,000 tons of indicated coal previously estimated. Revised estimates of the indicated reserves in the United No. 8 Bottom and Lowfield seams have also been made. These reserves now total 275,000 and 180,000 tons respectively and, in view of the greater density of borehole intersections now demanded for reserves of this category, possess a higher degree of reliability than the previous estimates.

REFERENCES

CAMERON, J. B., 1961: Coal resources—Rosewood–Walloon coalfield (Oakleigh mine area). *Qld Govt Min. J.*, *62*, 416-427.

22nd August, 1960.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(LANEFIELD No. 5 MINE AREA—EXTENSION)

By E. S. Chiu Chong

SUMMARY

Diamond drilling in 1955 established measured reserves amounting to 100,000 tons in the Lanefield No. 5 seam and 500,000 tons in the underlying Lowfield seam without apparently reaching the southern limit of reserves in the latter. Additional drilling was carried out towards the end of 1958 to extend reserves in that direction. Twelve holes totalling 2,961 ft. were drilled.

The Lanefield No. 5 seam was cored in only two holes, in which it showed unworkable sections.

The Lowfield seam was shown to be unworkable in the south-western part of the area, due either to deterioration of the coal or thickening of a stone band which splits the seam. The boundary of reserves here coincides with a line of faulting which trends north-west-south-east. In the south-eastern part of the area, the seam was proved to be workable over an area of approximately 77 acres with average coal thicknesses of 3 ft. 3 in. Additional measured reserves established in this part of the mine area have been calculated as approximately 420,000 tons.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

Lanefield No. 5 Mine Area, at present comprising C.M.L. 397, C.M.L. 490 (formerly C.M.L. application 342), C.M.L. 461, and C.M.L. 483, is held in the names of J. M. Bruce, A. J. Loveday, W. N. Ruhno, and N. G. Bruce, trading as Lanefield Collieries. In 1955, ten diamond drill holes totalling 2,897 ft., were drilled in the area, establishing measured reserves in the **Lanefield No. 5 seam** amounting to 100,000 tons, and 500,000 tons in the underlying **Lowfield seam.** The southern limits of reserves were apparently not reached (Cameron 1956).

With a view to proving additional reserves in this direction, twelve further holes, N.S. 135-146 inclusive, were drilled by the Department of Mines' Sullivan 22 H.D. plant between August, 1958, and January, 1959. Total footage drilled was 2,961 ft., the depth of hole ranging from 156 ft. 8 in. (N.S. 135) to 280 ft. 8 in. (N.S. 145). Overall core recovery was 92·6 per cent., average core recovery in the sampled sections being 91·4 per cent.

Boresites were selected by J. B. Cameron, Geologist, while the logging of cores was carried out by officers of the Geological Survey. All workable coal sections were examined by an Engineer Member of the Queensland Coal Board before being sampled. An attempt was made to obtain samples which would represent the market product after handpicking underground and at the surface. All analyses were carried out by the Government Analyst.

This report is accompanied by the following plans and diagrams:—

(*a*) Locality Map—fig. 1.

(*b*) Plan showing position of boreholes, surface contours at 10 ft. intervals, and boundaries of measures reserves—fig. 2.

(*c*) Generalised sections of boreholes—fig. 3.

(*d*) Diagrams showing detailed sections of the Lowfield seam, with analytical results—fig. 4.

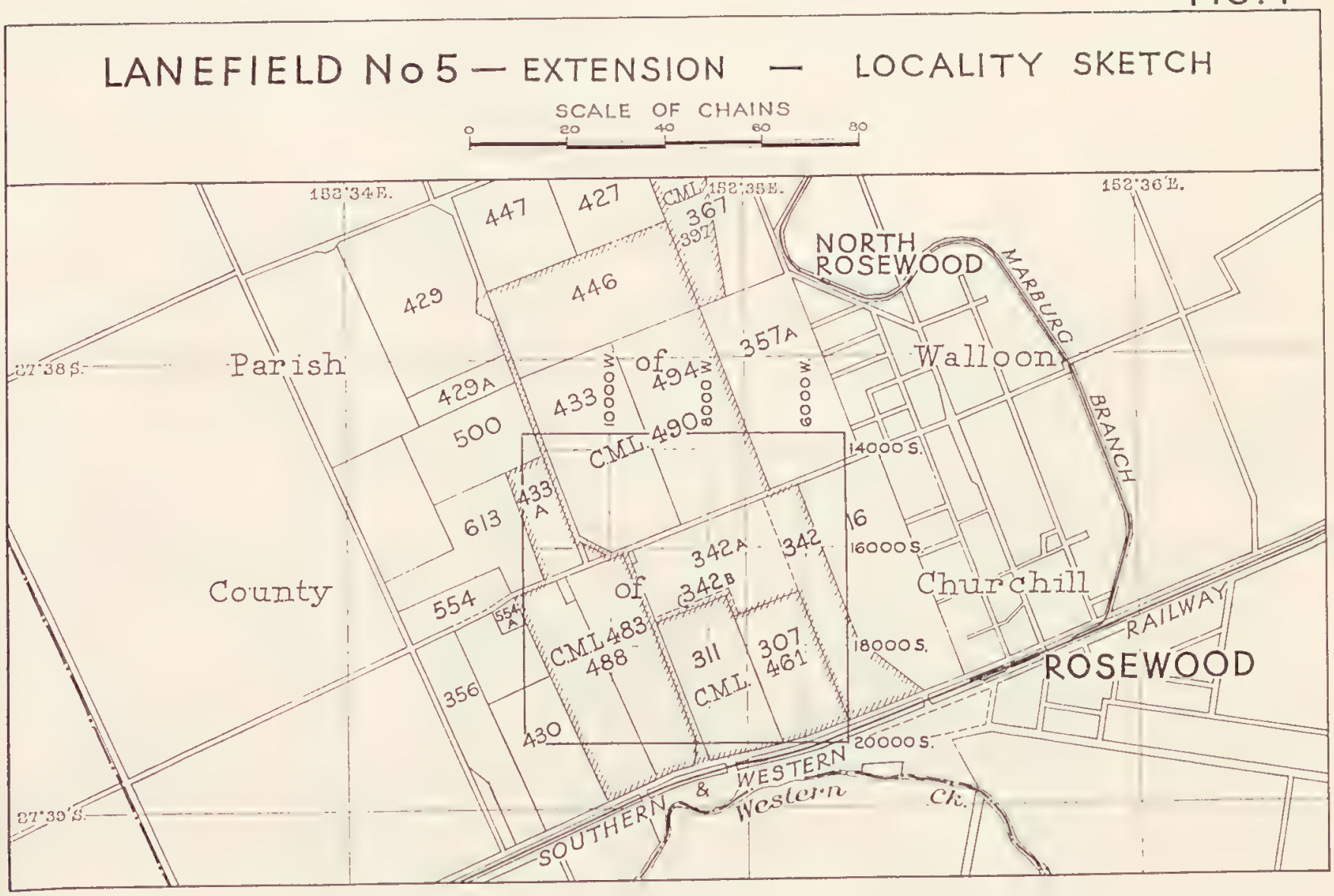
(*e*) Two cross-sections—fig. 5.

SUBSURFACE GEOLOGY

The **Lanefield No. 5 seam**, the present working seam of Lanefield No. 5 Colliery, was cored in only two boreholes N.S. 136 and N.S. 139. In the former hole, the seam, encountered at approximately 96 ft., was unworkable due to deterioration of the coal. In the latter borehole, the seam was encountered at approximately 182 ft. It was also unworkable due to excessive thickness of the two persistent shale bands; the upper one exceeding 6 ft., and the lower one, 4 ft.

The **Lowfield seam,** the main objective of drilling in this area, lies approximately 45 ft. in N.S. 139 and 60 ft. in N.S. 136 below the Lanefield No. 5 seam, the intervening strata being sandstones, siltstones and shales, with several thin coal bands. This seam, which contains one persistent band of distinct lithological character, a waxy fawn shale 3-6½ in. thick occurring near the roof, is split in the western part of the area by a lenticular stone band. This band may be correlated with the persistent grey shale band of the Westvale No. 5 Mine Area (Cameron, 1961). In the most north-westerly bore, N.S. 135, this band, consisting of white fine sandstone and grey shale, is 3 ft. 2 in. thick. South-easterly from this bore, it increases rapidly in thickness to a maximum in N.S. 136 of 8 ft. 9 in., and then decreases to 5 ft. 11 in. in N.S. 141, 9 in. in both N.S. 142 and N.S. 137, and 2 in. in N.S. 146. It could not be determined in N.S. 138 because of faulting, but is completely missing or represented by a penny band in the remaining five easterly

FIG. 1



boreholes. Thinning of this band probably occurs towards Lanefield No. 5 Colliery as no mention of such a band was made by Cameron (1956). Its thickness, as well as deterioration of the coal in some cases, has made the Lowfield seam in the western part of the area unworkable. However, workable sections were encountered in the five most easterly boreholes. Detailed sections of the Lowfield seam in these five holes are shown in figure 4, together with analytical results. The quality of the seam in N.S. 138 could not be determined due to faulting. Also in this hole, the coaly horizons obtained above the seam in the other boreholes are represented by carbonaceous shale. In N.S. 137, the coal below the grey shale split was found to be of workable thickness. Although not included in the area of measured reserves, this section was analysed, the details and results of which are shown on figure 4.

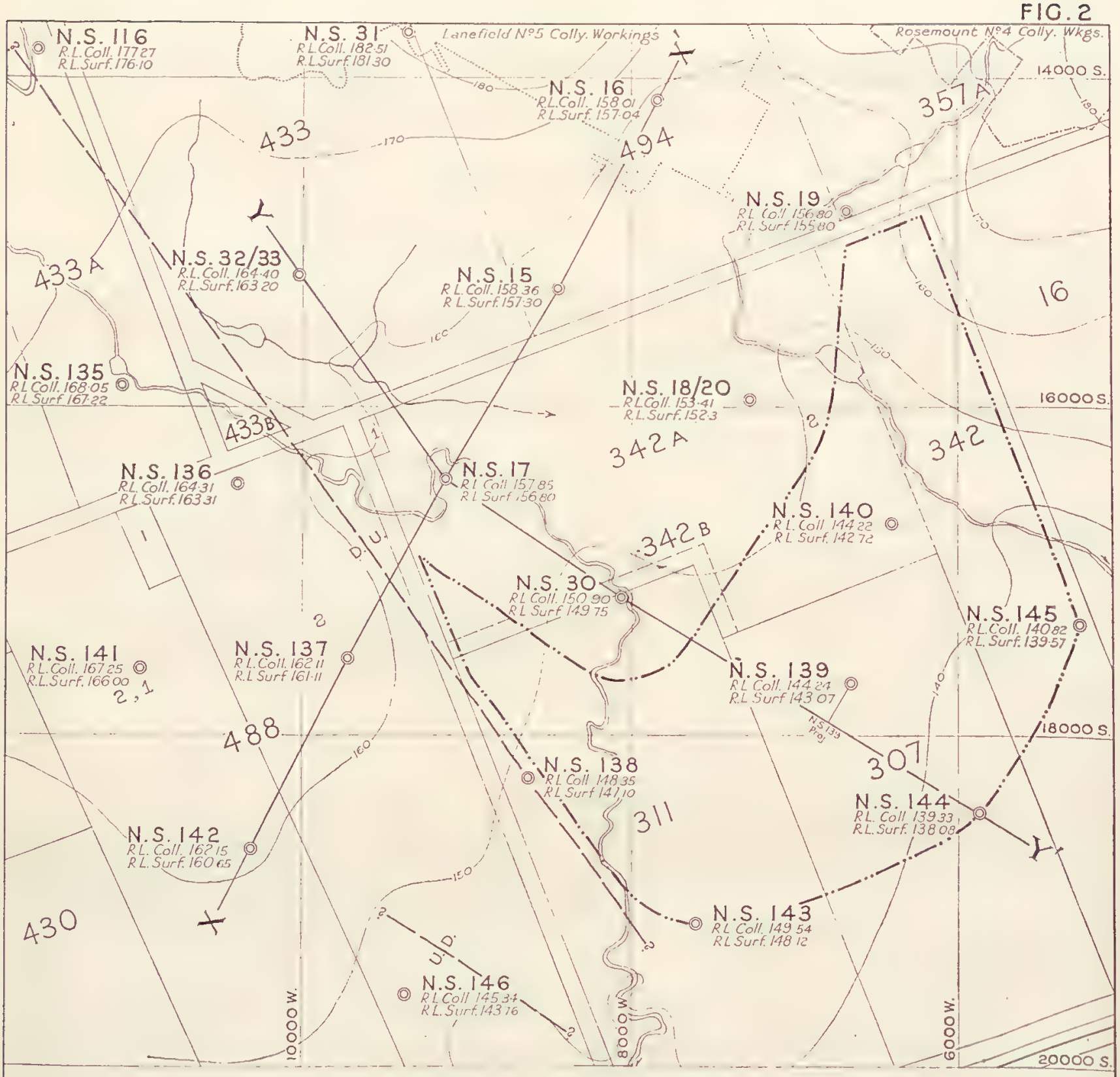
Only one borehole, N.S. 141, was drilled to a considerable depth below the Lowfield seam. Approximately 20 ft. below this seam, a coaly section which may be correlated, stratigraphically, with the "middle" seam (Cameron 1961) was penetrated, while the **Westvale No. 5 seam** was encountered 65 ft. below the Lowfield seam. Neither seam is workable in this hole.

STRUCTURAL GEOLOGY

The regional dip of the Walloon Coal Measures in the extension of Lanefield No. 5 Mine Area is approximately 3 deg. E.S.E., the change in the attitude of the beds from the south-easterly dip indicated by previous drilling in the area being probably caused by faulting, evidence of which was encountered in N.S. 136 above and below the Lowfield seam, and in N.S. 138. In the latter borehole, faulting occurred from 220 ft. to the bottom of the hole, and was so intense in the vicinity of the Lowfield seam, met at 243 ft. 11 in., that the quality of the seam could not be ascertained. A study of the reduced levels of the Lowfield seam in nearby boreholes suggests a line of faulting trending N.W.–S.E. (fig. 2). This line of faulting, mentioned by Cameron (1961), has a maximum downthrow on the south-western side of approximately 35 ft. in this mine area.

The study of reduced level of the Lowfield seam also suggests the presence of another line of faulting between the most southerly borehole, N.S. 146, and adjacent holes. This fault, possibly having much the same general trend as the one above, has a displacement of 20-30 ft., the south-western side being upthrown.

FIG. 2



DEPARTMENT OF MINES, QUEENSLAND

LANEFIELD No 5 MINE AREA — EXTENSION
WALLOON–ROSEWOOD COALFIELD

Showing topography, boreholes, mine workings and area of additional measured reserves

To accompany report by E.S. Chiu-Chong B.Sc.

Topographic survey by Ewan Cowley, Assistant Surveyor.

SCALE OF CHAINS

10 0 10 20

SURVEY DATA

Grid of 20 chain co-ordinates. Meridian of grid is True North at point of origin, Perry's Knob Trig. Station. Elevations in feet on State Datum

EXPLANATION

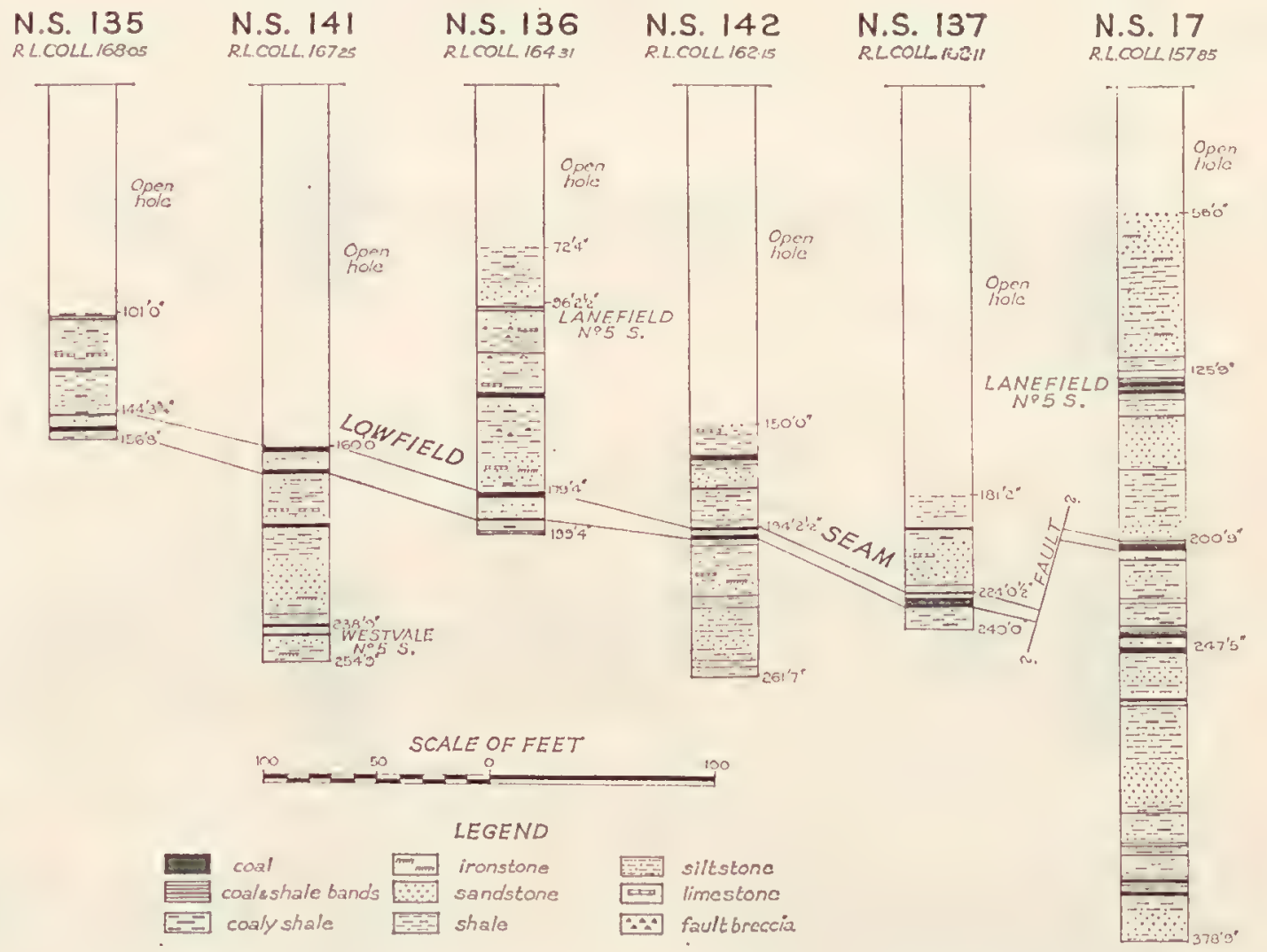
Diamond drillhole ◎ N.S.117 — Section line X——X'

Surface contour 170 — Fault (inferred) ?——?

Additional measured reserves, Lowfield Seam

FIG. 3

LANEFIELD No 5 – EXTENSION
GENERALISED BORE SECTIONS



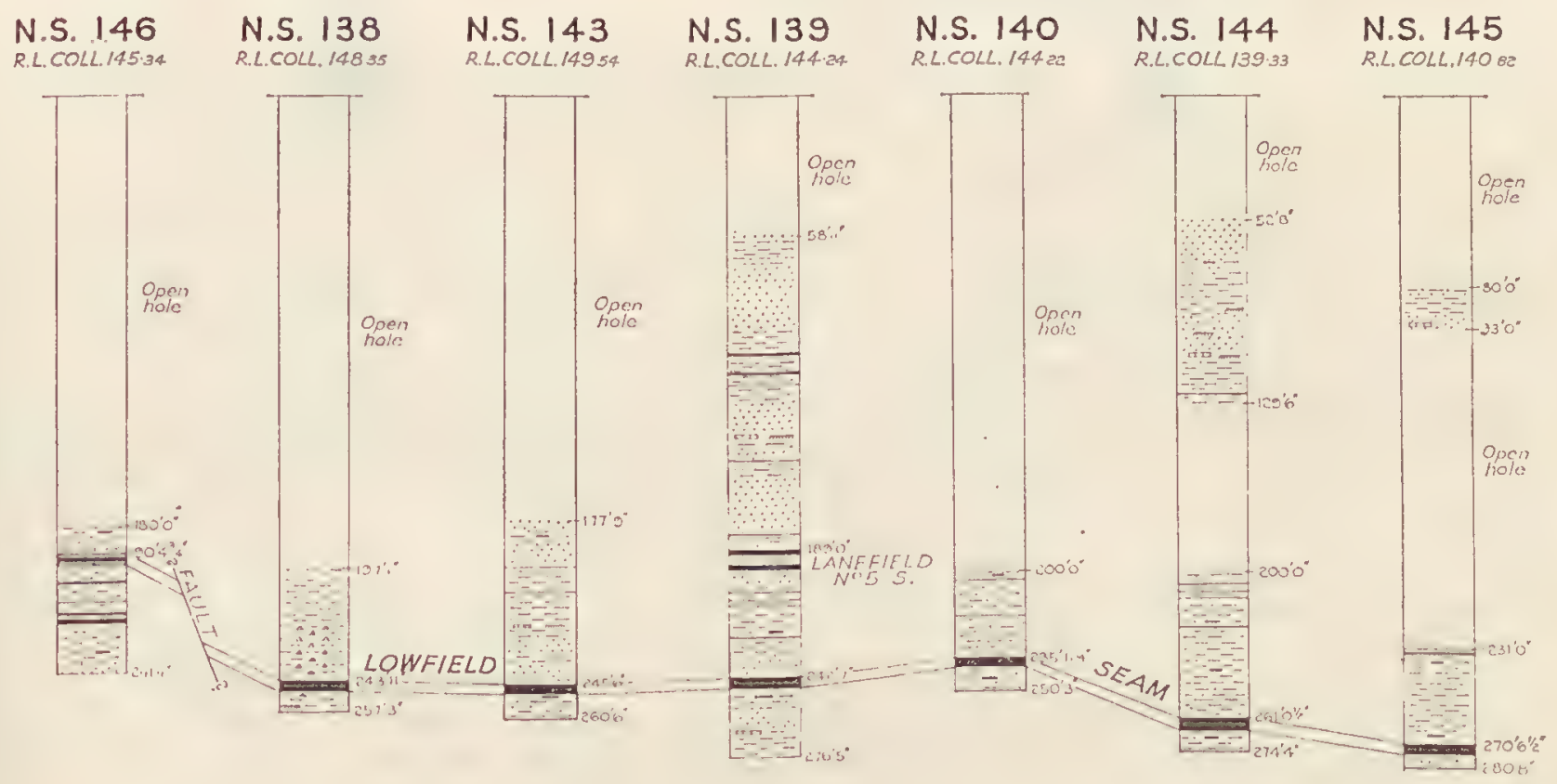
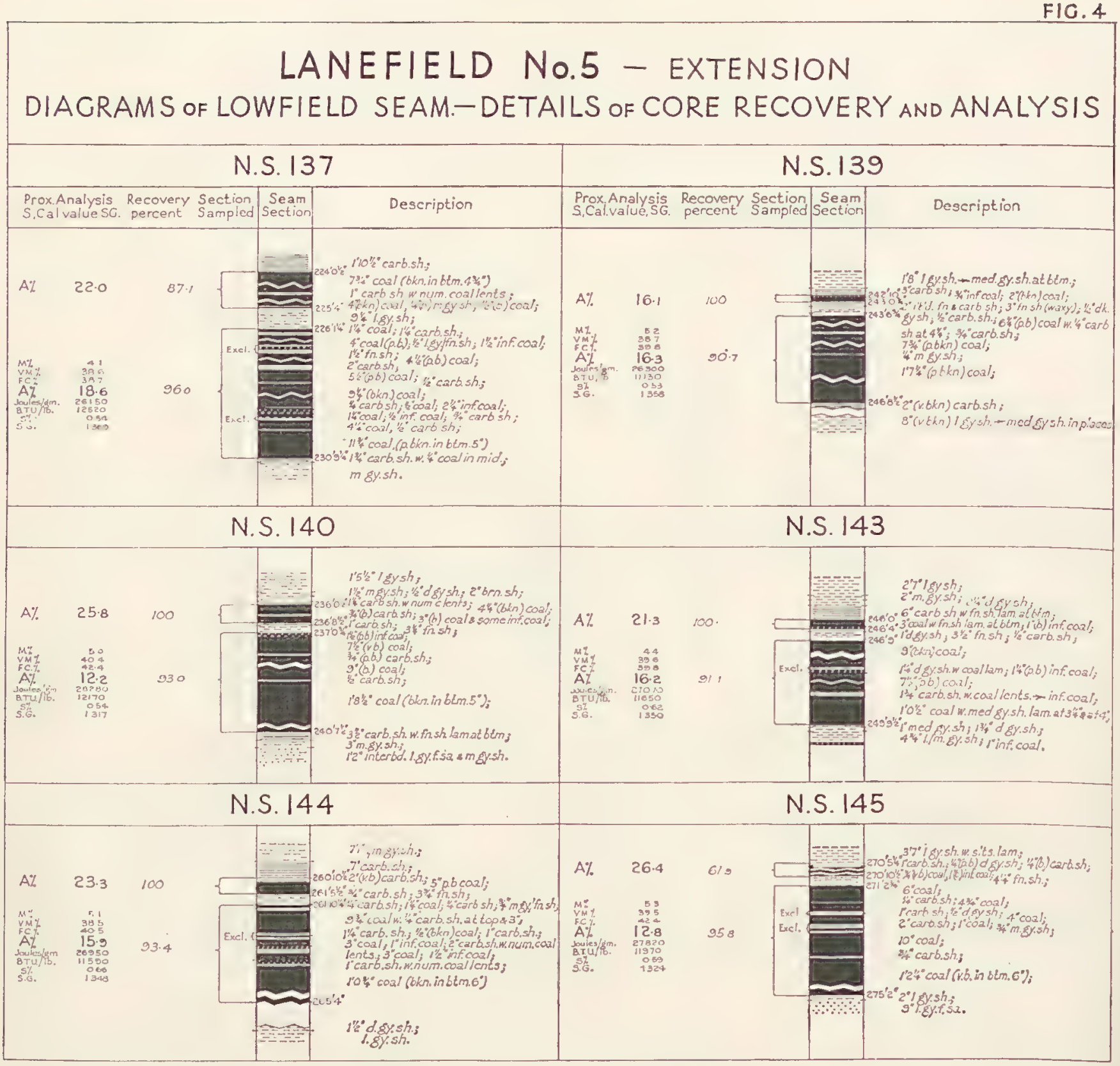


FIG. 4



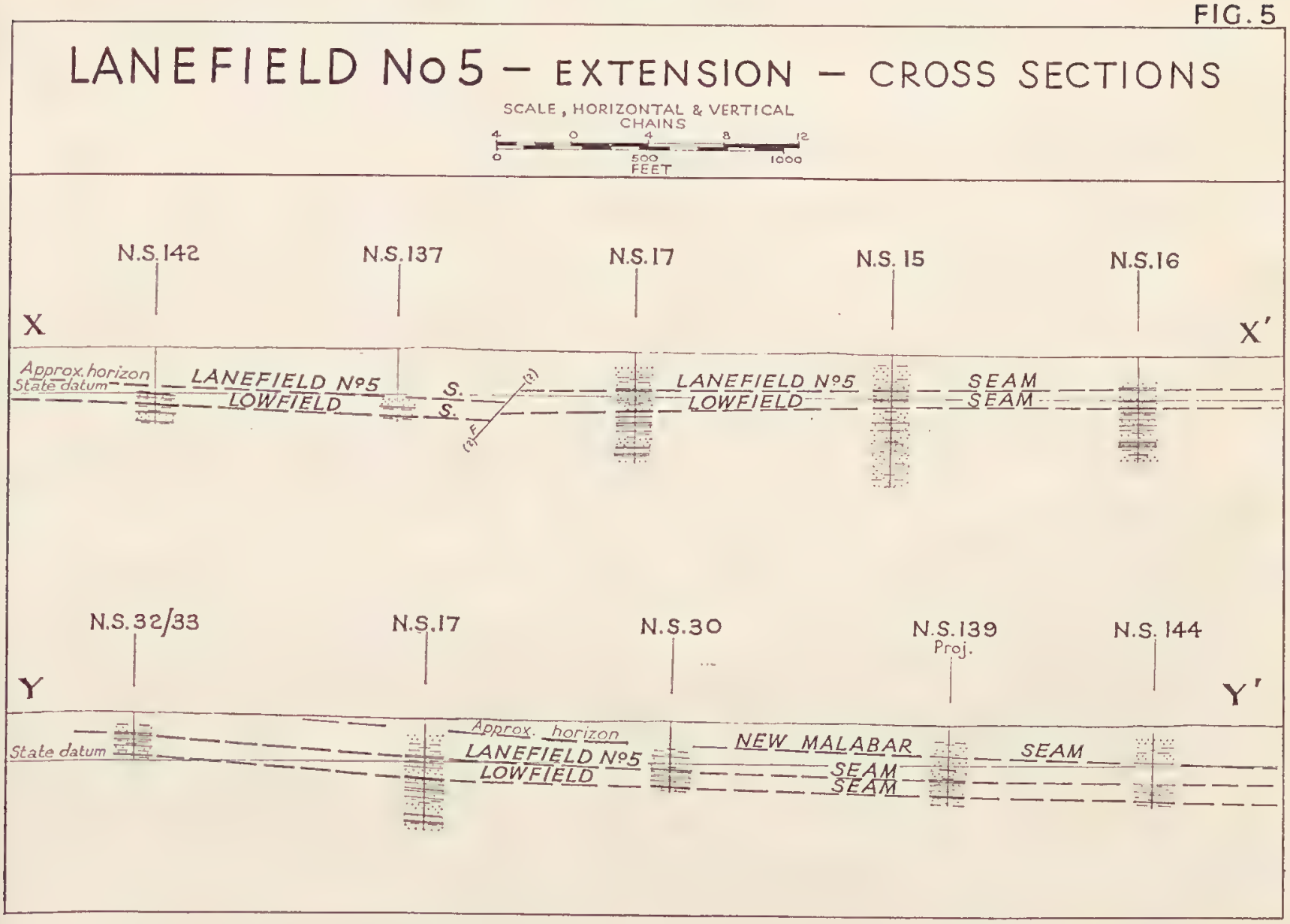
COAL RESOURCES

To be classified as "measured" reserves, a seam section must satisfy the following arbitrary conditions:—"A minimum thickness of three feet; a workable coal to stone ratio; and an ash content (after exclusion of stone bands normally removed in practice) of not more than 25 per cent. The area of measured reserves has been defined as extending no more than five chains from a peripheral point of observation (diamond drill hole or mine working)" (Cameron 1959).

The drilling of the extension of Lanefield No. 5 Mine Area has proved no addition to reserves of approximately 100,000 tons previously estimated in the **Lanefield No. 5 seam.**

However, reserves additional to the 500,000 tons previously estimated in the **Lowfield seam** (Cameron 1956) have been established. These reserves, extending over an area of approximately 77 acres, defined in the south-west by a line of faulting and embracing boreholes N.S. 139-140 and N.S. 143-145, total approximately 420,000 tons (fig. 2). Average thickness of the seam section below the waxy fawn shale band is 3 ft. 6 in., containing an average coal thickness of 3 ft. 3 in. Weighted average ash is 14·5 per cent. Additional reserves are unlikely to the south and south-east as peripheral bores show a workable section of just over three feet, but possible reserves may be found to the east and north-east towards

FIG. 5



Rosemount No. 4 Colliery, where the workable section obtained in peripheral boreholes is over 3 ft. 6 in. thick.

NATURE OF COAL

The coal of the Lowfield seam is of high volatile bituminous rank. Fixed carbon calculated on a dry mineral-matter-free basis varies from 51·1 per cent. to 52·5 per cent. Calorific value calculated on a moist mineral-matter-free basis varies from 13,420 to 14,190 B.T.U.'s per lb. Because of poor coking properties of Walloon coal, no coking tests were made.

CONCLUSIONS

A line of faulting, trending N.W.–S.E., traverses the area. It has a maximum displacement of approximately 35 ft., the south-western side being the downthrown side. This line defines the south-western limit of measured reserves, estimated to be 420,000 tons in the **Lowfield seam,** giving a grand total of 920,000 tons in this seam for Lanefield No. 5 Mine Area. There is no addition to the estimated reserves of 100,000 tons previously established in the **Lanefield No. 5 seam.**

REFERENCES

CAMERON, J. B., 1956: Coal resources—Rosewood–Walloon coalfield (Lanefield No. 5 mine area). *Qld Govt Min. J., 57,* 457-459.

————, 1959: Coal resources—Rosewood–Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

————, 1961: Coal resources—Rosewood–Walloon coalfield (Westvale No. 5 mine area). *Qld Govt Min. J., 62,* 302-307.

20th September, 1959.

S. G. Reid, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 310

COAL RESOURCES, ROSEWOOD-WALLOON COALFIELD

New Mountain View Mine Area
United No. 7 Mine Area

By J. B. CAMERON, B.Sc.App. (Geol.), Geologist

Roughrigg No. 5 Mine Area
Westvale No. 7 Mine Area

By E. S. CHIU CHONG, B.Sc., Geologist

BRISBANE
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1963

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COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(NEW MOUNTAIN VIEW MINE AREA)

By J. B. Cameron

SUMMARY

Drilling was first carried out in this area to locate and test the working seam beyond a major fault which had stopped colliery development to the south, and subsequently was extended to prove reserves. Seven holes were drilled, aggregate footage being 2,286 ft. 1 in.

Measured reserves, which are confined to the New Mountain View Bottom seam, have been calculated in two areas. To the north of the fault and east of abandoned workings, an area of 12½ acres which can now best be reached from United No. 7 Colliery, contains 70,000 tons. To the south of the fault in an area of 50 acres now being developed, reserves amount to 280,000 tons.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

Exploratory diamond drilling was carried out by the Mines Department in the New Mountain View mine area from September, 1956, to October, 1957. During the period, seven holes, N.S. 73, N.S. 81-83 and N.S. 95-97, were drilled by the Sullivan 22 H.D. No. 1 plant, aggregate footage being 2,286 ft. 1 in. Overall core recovery was 92·9 per cent.

All workable coal sections encountered during the drilling programme were examined by an Engineer Member of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone, both underground and on the surface. All analyses were carried out by the Government Analyst. Seam correlation is based on geological work carried out by W. L. Hawthorne, Assistant Geologist, in 1951, and the writer since 1956.

Accompanying the report are the following plans, sections and diagrams:—

(*a*) Locality Map together with Plan showing position of boreholes, extent of mine workings, surface contours at 20 ft. intervals and underground levels on State Datum, and boundaries of measured reserves—fig. 1.

(*b*) Generalised bore sections—fig. 2.

(*c*) Diagrams of New Mountain View Top and Bottom seams showing details of sections analysed and results—figs. 3 and 4.

(*d*) Two cross-sections—fig. 5.

MINE WORKINGS

New Mountain View Colliery is situated about 20 chains south-west of Tallegalla Railway Station and 3 miles north-north-west of Rosewood. Just over a half mile to the south-east lies the abandoned Mountain View Colliery. All these workings lie within an area held by Eric John Petie as Coal Mining Leases Nos. 343 and 465 (see Locality Map—fig. 1).

Operations first commenced in this mine area in 1944 at Mountain View Colliery. Although access at first was by means of a "daylight" tunnel, the No. 2 tunnel driven in 1946 was in the usual form of a cross-measure drift. Because of local topography, the seam was soon worked to the permissible 80 ft. depth of cover in all directions and so in 1952 the colliery was abandoned and operations transferred to New Mountain View Colliery. Although the Top seam was worked there for a short time, all production in recent years has come from the Bottom seam only a few feet beneath. The New Mountain View Top and Bottom seams occur considerably lower in the succession than that worked at Mountain View Colliery.

GENERAL GEOLOGY

The coal-bearing strata of the New Mountain View mine area belong to the Walloon Coal Measures of Jurassic age. Because of their characteristic lithology, these rocks are rarely seen in outcrop and so very little information can be gained from surface observations.

SUBSURFACE GEOLOGY

The highest coal seam in the succession in the New Mountain View mine area is that previously worked in Mountain View Colliery; there, it comprised two sections of coal—about 2 ft. of "tops" and 1 ft. 3 in. of "bottoms"—separated by 6-15 in. of grey shale. This seam which can be readily correlated on stratigraphic grounds with the **New Malabar seam** (Cameron, 1959) was penetrated only in boreholes N.S. 73 and N.S. 95; over most of the mine area it has been removed by erosion.

In the United No. 8 mine area to the south of New Mountain View the **United No. 8 Top and Bottom seams** lie 70-80 ft. beneath the New Malabar seam. Their behaviour there has been described in considerable detail by Cameron (1962). Although these seams can be recognised also in the New Mountain View area (see fig. 2) they are very poorly developed. The only workable section penetrated in either seam during the drilling programme was the 3 ft. 2 in. of coal (including 1 in. brown shale) encountered in

FIG.1

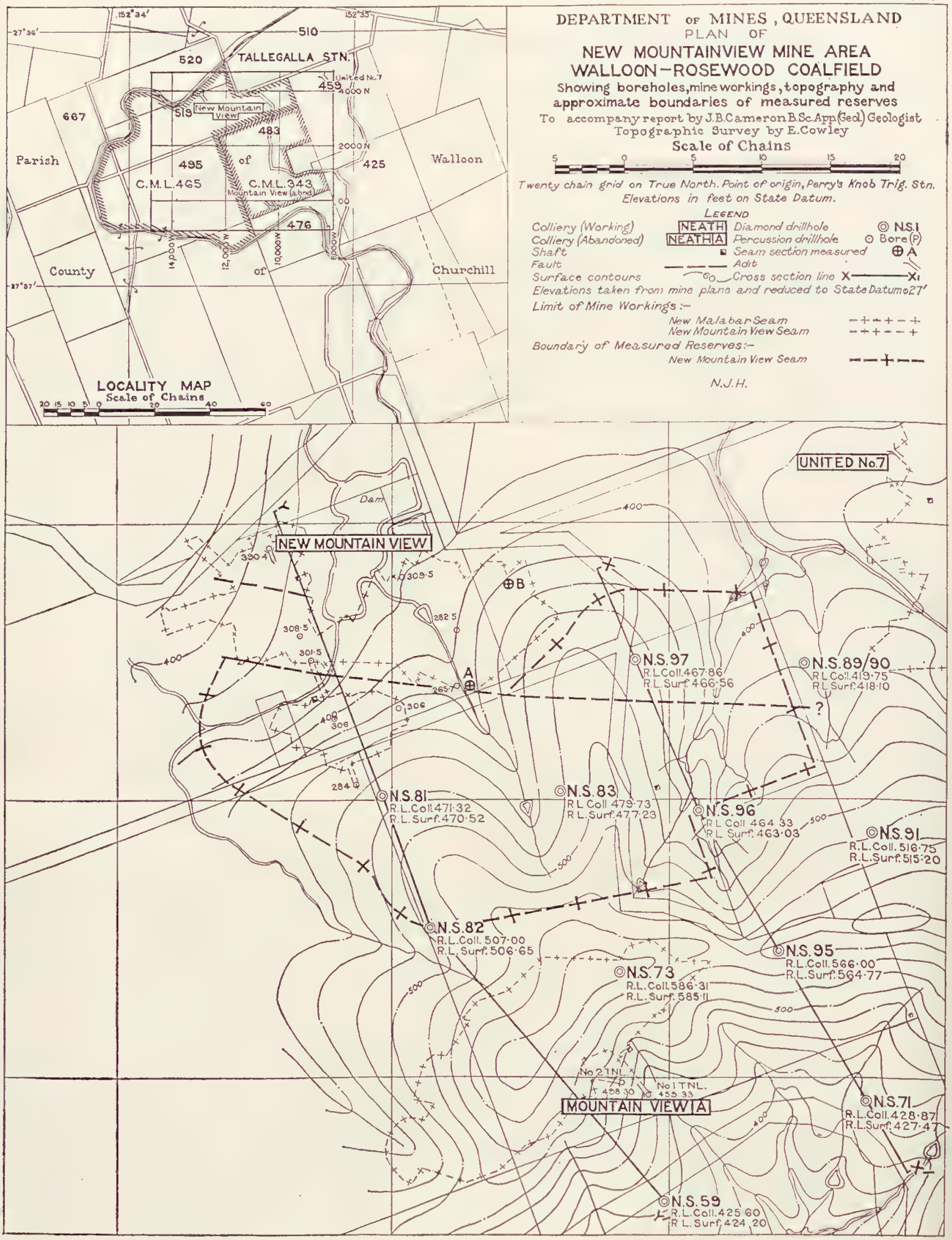
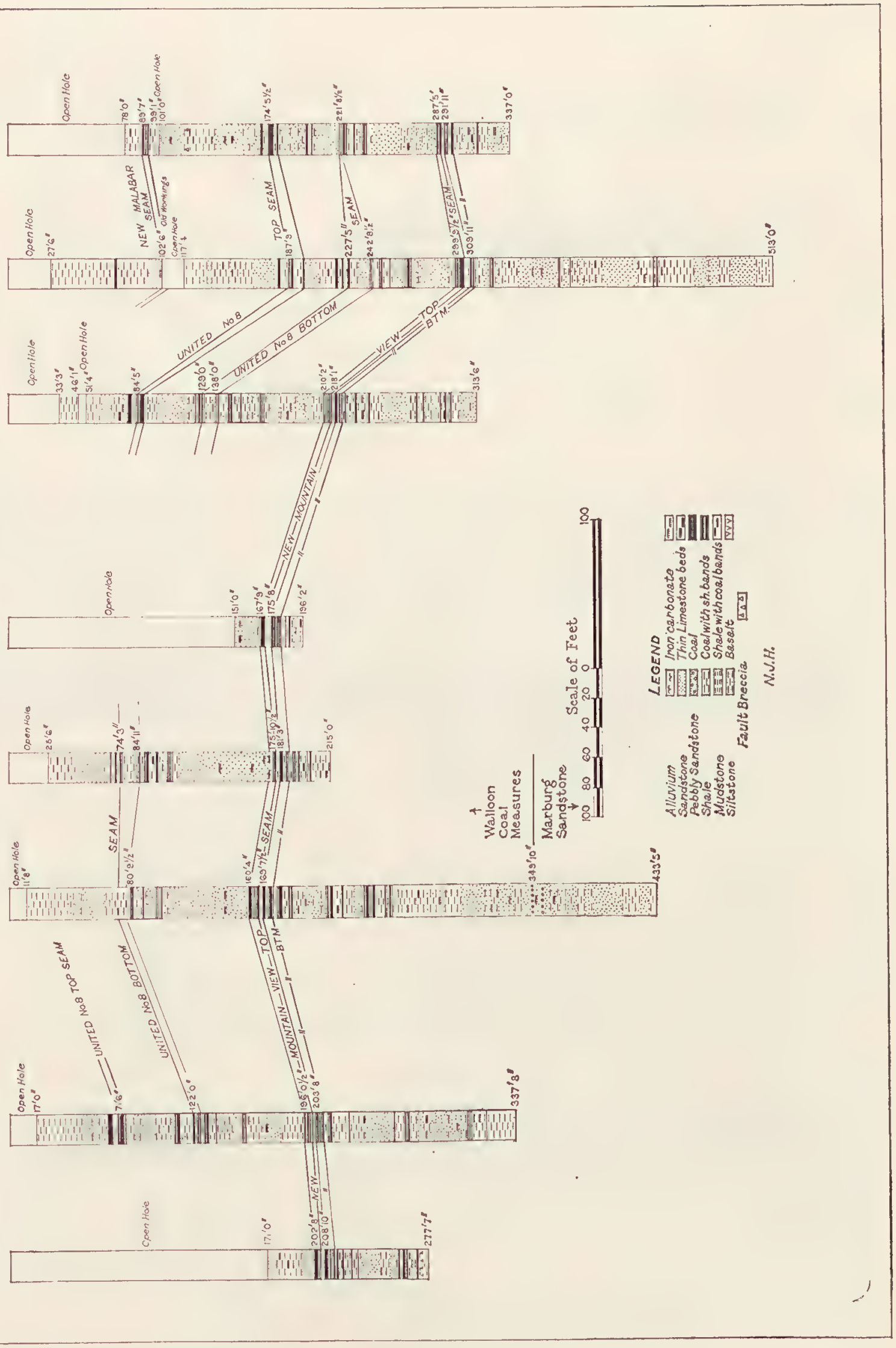

DEPARTMENT OF MINES, QUEENSLAND
PLAN OF
NEW MOUNTAINVIEW MINE AREA
WALLOON–ROSEWOOD COALFIELD
Showing boreholes, mine workings, topography and approximate boundaries of measured reserves
To accompany report by J.B.Cameron B.Sc.App.(Geol.) Geologist
Topographic Survey by E.Cowley
Scale of Chains
5 0 5 10 15 20
Twenty chain grid on True North. Point of origin, Perry's Knob Trig. Stn.
Elevations in feet on State Datum.
LEGEND
Colliery (Working)
Colliery (Abandoned)
Shaft
Fault
Surface contours
NEATH Diamond drillhole
NEATH A Percussion drillhole
Seam section measured
Adit
Cross section line X—X1
N.S.1
Bore (P)
A
Elevations taken from mine plans and reduced to State Datum 27'
Limit of Mine Workings:–
New Malabar Seam
New Mountain View Seam
Boundary of Measured Reserves:–
New Mountain View Seam
N.J.H.
LOCALITY MAP
Scale of Chains
20 15 10 5 0 20 40 60
152°34'
152°35'
27°36'
27°37'
510
520
TALLEGALLA STN.
United No.7
459
4000 N
519
New Mountain View
667
483
2000 N
Parish
495
of
425
Walloon
C.M.L.465
C.M.L.343
Mountain View (abnd)
476
14,000 W
12,000 W
10,000 W
8,000 W
County
of
Churchill
UNITED No.7
Dam
400
NEW MOUNTAIN VIEW
390·4
309·5
282·5
308·5
301·5
265·7
306
308
284
B
A
N.S.97
R.L.Coll.467·86
R.L.Surf.466·56
N.S.89/90
R.L.Coll.419·75
R.L.Surf.418·10
N.S.81
R.L.Coll.471·32
R.L.Surf.470·52
N.S.83
R.L.Coll.479·73
R.L.Surf.477·23
N.S.96
R.L.Coll.464·33
R.L.Surf.463·03
N.S.91
R.L.Coll.516·75
R.L.Surf.515·20
500
N.S.82
R.L.Coll.507·00
R.L.Surf.506·65
N.S.95
R.L.Coll.566·00
R.L.Surf.564·77
N.S.73
R.L.Coll.586·31
R.L.Surf.585·11
No 2 TNL.
498·30
No 1 TNL.
455·33
MOUNTAIN VIEW A
N.S.71
R.L.Coll.428·87
R.L.Surf.427·47
N.S.59
R.L.Coll.425·60
R.L.Surf.424·20

FIG. 2

NEW MOUNTAIN VIEW—GENERALISED BORE SECTIONS



borehole N.S. 95 at a depth of 174 ft. 5½ in.; this section represents the "tops" of the United No. 8 Top seam.

The **New Mountain View Top seam** lies approximately 55-85 ft. below the United No. 8 Bottom seam, the intervening strata being predominantly sandstones with three persistent but unworkable coal seams in the top 18-30 ft. In boreholes N.S. 73 and N.S. 81-82 the seam is 6-7 ft. thick but contains numerous thin bands of carbonaceous and fawn shale. Because of its stratigraphic position and the presence of a light coloured, waxy shale band about 2 ft. from the roof, this seam is correlated with the **Lowfield seam** described previously (Cameron, 1962). In the remaining boreholes, the New Mountain View Top seam is only 3-5 ft. thick. This reduced thickness is undoubtedly due to contemporaneous erosion, for in these holes, in contrast with the other observation points, the seam has a sandstone roof. Detailed seam sections with analytical results are shown in figs. 3 and 4.

The **New Mountain View Bottom seam** lies usually 2-5 ft. below the Top seam. However, in the earliest workings of New Mountain View Colliery there is less than 1 ft. of shale between the seams. As a result, the section worked at that time included the Top seam and the top 20 in. coal ply of the Bottom seam. As the workings extended to the south, the shale between the two seams grew rapidly and so operations were transferred to the Bottom seam itself. This is the present working section. As exposed underground, the New Mountain View Bottom seam is 5-6 ft. thick and comprises two sections of coal, each usually about 20 in. thick, separated by a succession of coal and grey shale beds of varying thickness. The greatest variation in this regard is shown by the topmost shale which decreases from 2 ft. in the west to only a few inches in the east. This improvement eastwards in the working section is offset to some extent by the growth of a median shale band in the bottom section of coal to as much as 8 in. Within the area tested by diamond drilling, the top section of coal in the Bottom seam is always of the usual good quality and thickness but in places the shale bands in the other parts of the seam are considerably thicker (see figs. 3 and 4). Only in boreholes N.S. 81-83 and N.S. 96-97 is the stone to coal ratio in the Bottom seam sufficiently low to provide a workable section.

In borehole N.S. 81, thin coal seams were encountered for 80 ft. below the New Mountain View Bottom seam. With the exception of 15-18 in. of coal which lies only a few inches below the floor of the Bottom seam in boreholes N.S. 81 and N.S. 97 and which could be included thereabouts in the working section, none of these seams is of economic interest. This lower part of the coal measures was fully tested in only one other borehole, N.S. 73; there thin coal seams persist for 130 ft. below the New Mountain View Bottom seam.

Drilling was continued in N.S. 81 to a depth of 433 ft. 5 in. For 92 ft. below the last seam encountered, that is, from 257 ft. 7½ in. to 349 ft. 10 in., the strata consist of fine grained sandstone, shale and siltstone of similar lithology to that of the overlying beds but without coal seams. Below 349 ft. 10 in. thin beds of coarse pebbly sandstone occur interbedded with the usual Walloon-type rocks. This bottom 83 ft. is correlated with the **Marburg Sandstone** which outcrops a few miles to the north. In borehole N.S. 73 the Marburg Sandstone was not reached, drilling being discontinued some 70 ft. below the lowermost coal.

STRUCTURAL GEOLOGY

When drilling commenced in the New Mountain View mine area, colliery development to the south had been stopped by a major fault trending almost east-west and dipping northwards at approximately 70 degrees. A fault of somewhat similar attitude had already been encountered and successfully penetrated in the workings 5-6 chains up dip, the displacement there being 7 ft. up to the south. Efforts to locate the seam beyond the second fault, however, were unproductive; available evidence indicated an upthrow of at least 30 ft. to the south.

As drilling progressed, a study of the reduced levels of the floor of the New Mountain View Bottom seam failed to reveal any major displacement of the working section in the vicinity of boreholes N.S. 81-82, although to the east around boreholes N.S. 95-96 an upthrow to the south of some 60 ft. was proved. At this stage, however, the fault was once again penetrated underground to the north of borehole N.S. 81 and a stone rise driven to expose some 30 ft. of strata dipping southwards away from the fault at angles up to 30 degrees. Correlation of these beds with a sequence beneath the New Mountain View Bottom seam in borehole N.S. 81 showed that in the immediate vicinity of the fault plane displacement was of the order of 50-60 ft. This suggested that with increasing distance from the fault plane the displacement of the working seam became less and less, the steep southerly dip of the beds cancelling out the effects of faulting. Near borehole N.S. 81, therefore, the seam would have once again attained its usual grade. Subsequent underground development has shown this interpretation to be basically correct (see fig. 5).

Away from the influence of this major fault, the Walloon Coal Measures in the New Mountain View area are almost horizontal, regional dip being about 2 degrees to the south-east.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings):—

(*a*) measured reserves—up to 12½ chains.

(*b*) indicated reserves—more than 12½ chains.

NEW MOUNTAIN VIEW MINE AREA
ROSEWOOD
DETAILS OF CORE RECOVERY AND ANALYSES
NEW MOUNTAIN VIEW TOP & BOTTOM SEAMS
To accompany report by J.B.Cameron, B.Sc.App (Geol)

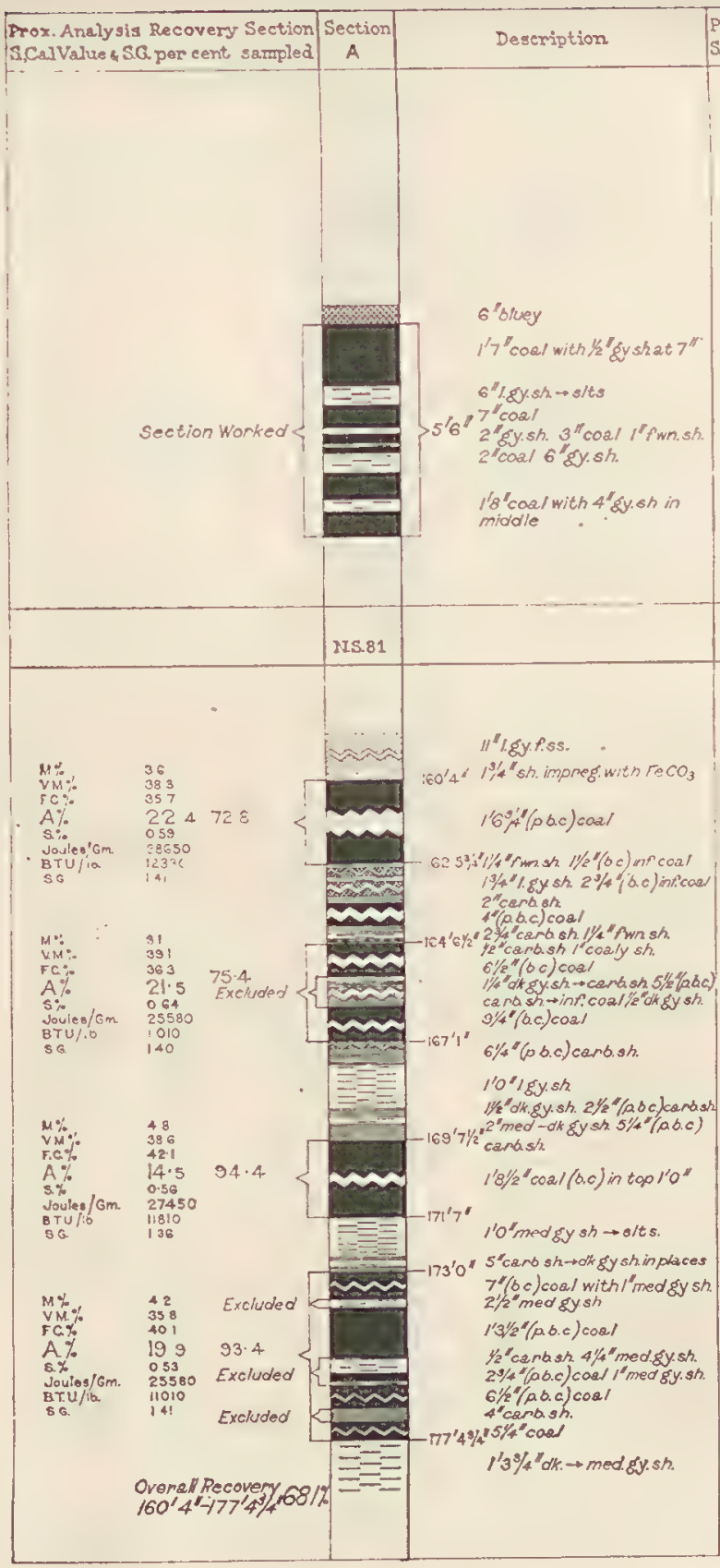

Prox. Analysis Recovery Section S,Cal Value & S.G. per cent sampled
Section A
Description
Section Worked
5'6"
6" bluey
1'7" coal with ½" gy sh at 7"
6" l gy.sh → slts
7" coal
2" gy.sh. 3" coal 1" f wn.sh.
2" coal 6" gy.sh.
1'8" coal with 4" gy.sh in middle
M% 3 6
V.M.% 38 3
F.C.% 35 7
A% 22 4 72 8
S% 0 59
Joules/Gm. 28650
BTU/lb. 12330
S.G. 1 41
M% 3 1
V.M.% 39 1
F.C.% 36 3
A% 21 5 75 4
S% 0 64 Excluded
Joules/Gm. 25580
BTU/lb 1010
S.G. 1 40
M% 4 8
V.M.% 38 6
F.C.% 42 1
A% 14 5 94 4
S% 0 56
Joules/Gm. 27450
BTU/lb 11810
S.G. 1 36
M% 4 2 Excluded
V.M.% 35 8
F.C.% 40 1
A% 19 9 93 4
S% 0 53 Excluded
Joules/Gm. 25580
BTU/lb. 11010
S.G. 1 41 Excluded
160'4"
104'6½"
167'1"
169'7½"
171'7"
173'0"
177'4¾"
11" l gy. f ss.
1¾" sh. impreg. with $FeCO_3$
1'6¾" (p b c) coal
62 5¾" 1¼" f wn.sh 1½" (b c) inf coal
1¾" l gy sh 2¾" (b c) inf coal
2" carb sh
4" (p b c) coal
2¾" carb sh 1¼" f wn sh.
½" carb sh 1" coaly sh.
6½" (b c) coal
1¼" dk gy sh → carb sh 5½" (p b c)
carb sh → inf coal ½" dk gy sh.
9¾" (b c) coal
6¼" (p b c) carb sh.
1'0" l gy sh
1½" dk gy sh 2½" (p b c) carb sh
2" med - dk gy sh 5¼" (p b c) carb sh.
1'8½" coal (b c) in top 1'0"
1'0" med gy sh → slts.
5" carb sh → dk gy sh in places
7" (b c) coal with 1" med gy sh
2½" med gy sh
1'3½" (p b c) coal
½" carb sh 4¼" med gy sh.
2¾" (p b c) coal 1" med gy sh.
6½" (p b c) coal
4" carb sh.
1'3¾" dk. → med gy sh.
Overall Recovery 160'4"-177'4¾" 68 1%
Prox Analysis Recovery Section S,Cal Value & S.G. per cent sampled
Section B
Description
Section Worked
3'5¼"
4'9"
M% 6 2
V.M.% 36 4
F.C.% 40 9
A% 16·5
S% 0 71
Joules/Gm 26060
BTU/lb 11210
S.G. 1 36
A% 10·9
S.G. 1 30
Roof :- dk gy sh
2'1" coal with ¼" carb sh at 7½" & ½" carb sh at 1'3½" and 1'6"
1" carb sh ¾" f wn sh 2½" carb sh
1" f wn sh 2" coal 2" dk gy sh.
7" coal
3" inf coal 4½" bluey
5" med gy sh.
8" l gy s/ts. → f ss. 1" med gy sh.
4" inf coal
1'6" coal with ½" carb sh at 5½"
3" dk gy sh.
3½" coal 1½" carb sh 3" coal with ¼" carb sh in middle 1" f wn sh 2" coal 6" dk gy sh.
8" coal
5" gy sh with 1" coal in middle
6" coal
Floor :- sh
196'0½"
198'3½"
201'11"
203'8"
207'10½"
208'0¾"
214'10½"
med gy sh.
7¼" coal with $CaCO_3$ streaks
3½" carb sh
3¾" coal ¾" carb sh - dk gy sh 5¼" f wn bent sh ¾" (b c)
inf coal 1½" carb sh ½" coal
¾" carb sh ½" coal ½" inf coal
7¼" coal ½" carb sh
4½" (p b c) coal ½" carb sh
¾" (b c) coal 2" carb sh.
6" (b c) coal
1¼" carb sh 1" med gy sh.
2¼" (p b c) carb sh ¾" dk gy sh.
¼" carb sh ¾" f wn sh ¾" (p b c)
carb sh 7" (p b c) coal
5½" carb sh 3" med gy sh.
1'0½" carb sh
1¾" (p b c) coal ¾" dk gy - carb sh
11" coal (p b c) in btm 6"
1¾" med gy sh ½" carb sh
1'1" coal (b c) in btm 5½"
1¼" l gy sh 1¾" (b c) coal
1" (p b c) l gy sh
10½" coal (b c) in top 5½"
2¼" carb sh 4" coal (b c) in btm 2" 3½" carb sh
1" coal 1½" l gy sh
7" coal (b c) in 5¾"
3¾" med gy sh.
4¾" (p b c) coal 1½" carb sh.
1'0¾" l gy. - med gy sh
2" dk gy - carb sh. 2¼" coal
½" carb sh. ½" dk gy sh
1¾" coal 1¼" l. - med gy sh.
4" (p b c) coal 3¼" med gy sh.
½" inf coal 2½" med gy sh
4" coal 1" carb sh. 1" dk gy sh.
2½" coal ½" dk gy sh.
1¼" (p b c) coal
Interbd. l gy. slts & med gy sh.
M% 4 5
V.M.% 39 8
F.C.% 41 8
A% 13 9 Excluded
S% 0 51 85 4
Joules/Gm 27940
BTU/lb 12020 Excluded
S.G. 1 34
M% 4 2
V.M.% 37 9
F.C.% 41 0 Excluded
A% 16·9 98 8
S% 0 57
Joules/Gm 26320 Excluded
BTU/lb 11410 Excluded
S.G. 1 37 Excluded
Excluded
Excluded
Excluded
Excluded
Excluded
Excluded
Excluded
Overall Recovery 196'0½"-214'10½" 91·7%
Prox. Analysis Recovery Section S,Cal Value & S.G. per cent sampled
Section N.S.97
Description.
M% 4 7
V.M.% 35 6
F.C.% 37 2
A% 22·5 8 2
S% 0 66
Joules/Gm 24040
BTU/lb 10340
S.G. 1 45
M% 5 2
V.M.% 36 9
F.C.% 41 6 87·5
A% 16 3 Excluded
S% 0 58
Joules/Gm 26430
BTU/lb 11370
S.G. 1 40
M% 4 4
V.M.% 34 4
F.C.% 37 0
A% 24·2 Excluded 97·8
S% 0 48
Joules/Gm 23740
BTU/lb 10210
S.G. 1 46
A% 23 0 74·0
S.G. 1 45 Excluded
M% 4 3
V.M.% 35 3
F.C.% 38 5 Excluded
A% 21 9 Excluded 91·7
S% 0 47
Joules/Gm. 24350
B.T.U/lb. 10560
S.G. 1 44
202'8"
205'6½"
209'10"
211'6"
212'5"
216'3"
217'2¾"
218'3¾"
219'1"
221'1"
1 gy f arg ss.
2" carb sh.
1'6½" (p c) coal with ½" carb sh at 1'0" & f sh trash in btm 2½"
2½" (b c) carb sh
1½" (b c) inf coal
5½" (b c) coal 1½" carb sh.
¾" (b c) coal 2" carb sh.
2¼" carb sh (o/l sh)
1'8½" med gy slicken sided sh.
2½" dk gy sh
10" carb sh
1'0½" (b c) coal
2¼" med gy sh (fractured)
7" (p b c) coal
1¼" carb sh
5" (b c) coal
6½" l gy sh (fractured)
3¾" med gy sh ¾" dk gy sh.
11" coal (b c) in btm 7"
5½" dk gy sh
4½" coal (b c) in btm. 2"
2¼" carb sh
4¾" (b c) med gy sh.
1'0½" (b c) coal with ½" med gy sh at 4½" 5½" carb sh at 11"
2½" (p b c) carb sh 2" (b c) coal
10½" med gy sh.
4½" (b c) coal
¾" carb sh ½" med gy sh.
½" inf coal 3" (b c) coal
3" l gy slts 6¾" med gy sh.
1" inf coal 1¼" carb sh
4" coal (b c) in top 3" 2" carb sh
1" med gy sh 4¼" inf coal
8½" coal (b c) in btm 4"
½" med gy sh.
l. gy. sh with few l gy. slts. bds.
Overall Recovery 202'8"-221'1" 92·4%

FIG.4

NEW MOUNTAIN VIEW MINE AREA
ROSEWOOD

DETAILS OF CORE RECOVERY AND ANALYSES
NEW MOUNTAIN VIEW TOP & BOTTOM SEAMS

To accompany report by J.B.Cameron, B.Sc.App.(Geol) NJH

Section N.S.82

Prox. Analysis S,Cal.Value & S.G.	per cent	Recovery per cent sampled	Description
			med gy sh. ¾" coal
			210'2¼" 7¼" med gy sh. 1" carb sh.
			9¼" (p b c) coal with ¼" med gy sh. at 7" 2" (p b c) coal & inf. coal → carb. sh. ¾" f.wn.sh
			211'11¼" 1½" inf. coal ¾" f.wn.sh. ¾" carb sh. 4" coal (b.c) in btm 2½"
			212'7½" 2" dk gy sh 4" f.wn.sh ½" coal
			2" carb sh. 6" (b c) coal
			1¼" (b c) carb sh 1¼" (b c) coal
			4¼" carb sh. → inf. coal in places
			2" (p b c) coal ½" f.wn.sh. 1½" coal
			¾" carb sh 5½" (p b c) coal
			¾" dk gy sh 1" med gy – f.wn.sh
			10" (b c) coal
			216'3½" 8" (p b c) carb sh
			8¾" dk gy sh.
			218'0¾" 4½" carb sh.
			10" coal (b c) in btm 3½"
			½" carb sh
			6½" coal (b c) top 3" & btm 2"
			1'3½" l.–med.gy.s/ts.→sh.
			1½" inf. coal
			5½" coal (b c) in top 3½"
			222'2¾" 5½" f.wn.sh 2½" coal (b.c) btm 3¼"
			5¼" l.gy.sh. faulted junction with underlying 5½" coal
			4¾" med-dk gy sh.
			2¼" (b c) coal
			5" med gy sh 1½" (b c) coal
			¾" l.gy sh 4½" coal (b.c) top 4"
			5" carb. sh.
			3" (b c) coal
			3¼" l.–med.gy sh ½" dk gy sh.
			l.–med gy sh.

Overall Recovery 210'1¾"–222'2¼" 89.3%

Section N.S.83

Prox. Analysis S,Cal.Value & S.G.	per cent	Recovery per cent sampled	Description
			l gy f ss.
			½" carb sh 2½" (p b c) coal
			½" carb sh. 5" f.wn.sh.
			2¼" (p b c) coal 2" dk gy.–carb sh
			1'3" carb sh
M% 4.4			178'0" ½" coal 1" carb sh.
V.M.% 39.3			9" (p b c) coal
F.C.% 37.6			1½" dk gy sh 1¼" f.wn.sh
A% 18.7	76.3	Excluded	4¾" (p b c) coal
S% 0.62			¾" dk gy sh
Joules/Gm 26180		Excluded	178'4½" 4½" (b c) coal
BTU/lb. 11260			½" dk gy – carb sh 1¼" coal
S.G. 1.38			9" carb sh
			2" dk gy sh
			1½" med gy sh
			2" dk gy – carb sh
			181'3" 7¼" carb sh
M% 4.5			4¾" (p b c) coal
V.M.% 39.9			1" carb sh
F.C.% 42.9			1" (b c) coal
A% 12.7	87.3		¾" dk gy sh
S% 0.69			6½" (p b c) coal
Joules/Gm. 28480		Excluded	9" med gy sh
BTU/lb 12250			2" (p b c) coal
S.G. 1.34			6¼" l.gy sh. ¾" carb sh.
			10" (b c) coal
			186'2" ¾" dk gy sh 1" coal
			5" carb sh 1¼" coal
			2¼" dk med gy sh 2¼" (p b c) coal 1" l gy sh 4½" (b c) coal
			1½" dk gy – carb sh 4½" dk–med gy sh ¾" dk gy – carb. sh.
			3¾" (b c) coal 1¼" dk gy sh.
			11½" l.–med. gy sh.

Overall Recovery 176'0"–186'2" 90.2%

Section NS73

Prox. Analysis S,Cal.Value & S.G.	per cent	Recovery per cent sampled	Description
			l gy s/ts.
			1'5½" l gy → dk gy sh.
M% 3.7			299'9½" 7" (p b c) coal
V.M.% 36.7			3½" inf coal → coal
F.C.% 32.3			1" (p b c) carb sh
A% 27.3	62.6		301'1¾" 3¾" (p b c) coal
S% 0.47			1¾" l coal f.wn.sh ½" carb sh
Joules/Gm. 23040			302'7½" 1" coal 3.2" carb sh → dk gy sh
BTU/lb. 9910			10¼" coal with 2" carb sh at 6"
S.G. 1.45			2" med gy sh 4½" (b c) coal
			½" dk gy – carb sh 4" (b c) coal
M% 4.3			2" (p b c) med gy sh
V.M.% 34.5		Excluded	11¾" (b c) coal
F.C.% 32.0			306'0½" 4½" (p b c) l gy sh.
A% 29.2	83.6		
S% 0.48			
Joules/Gm 21810			
BTU/lb 9300			
S.G. 1.48			
			1'11" l gy s/ts
			6" med – dk gy sh
M% 5.0			309'10¼" 3" (p b c) carb sh 1.4" dk f.wn.sh
V.M.% 36.0			2" (p b c) carb sh
F.C.% 41.1			1'3.2" (p b c) coal
A% 17.9		Excluded	1¾" dk gy sh
S% 0.67	84.3		9" (p b c) coal
Joules/Gm. 25500			
B.TU/lb 10970		Excluded	313'3½" 3¼" l–med gy sh ¼" dk gy sh
S.G. 1.35			5" (b c) coal
			7" carb sh
			l gy f ss.

Overall Recovery 299'9½"–313'3½" 81.5%

Section N.S.95

Prox. Analysis S,Cal.Value & S.G.	per cent	Recovery per cent sampled	Description
			l gy f ss
			3" l gy f.arg ss
			9¼" carb sh ½" (p b c) coal
			9¼" carb sh
M% 4.8			287'5¼" 2¾" inf coal
V.M.% 36.7			1'0" (p b c) coal
F.C.% 36.3			½" (p b c) f.wn.sh.
A% 22.2		100	1'3" (b c) coal
S% 0.58			289'8¾" 4½" carb sh
Joules/Gm 23350			4.2" dk gy sh 6" med gy sh, 2" dk gy sh 3½" carb sh
BTU/lb 9300			6" dk gy sh.
S.G. 1.42			291'11" 1¼" carb sh
			10" (b c) coal
M% 4.9			2¾" med gy sh.
V.M.% 38.1			293'5½" 5¾" (b c) coal
F.C.% 42.0			6½" dk gy sh.
A% 14.1		100	2¼" (b c) coal
S% 0.64		Excluded	¼" (p b c) f.wn.sh 2.2" (b c) coal
Joules/Gm 27250			
BTU/lb 11730			2'3" med gy sh
S.G. 1.37			
M% 4.2			295'0¾" ½" dk gy sh 2" carb sh.
V.M.% 38.3			1'1½" (b c) coal
F.C.% 41.0			298'0¼"
A% 10.5		100	9" carb sh
S% 0.61			1.4" l gy sh ½" dk gy sh 1¾" (b c) coal 2¼" f.wn.sh 3" (b c) coal
Joules/Gm. 26590			1'0" l gy s/ts.
BTU/lb 1440			
S.G. 1.38			l gy → med gy s/ts.

Overall Recovery 287'5¼"–299'0¼" 99.4%

Section NS96

Prox. Analysis S,Cal.Value & S.G.	per cent	Recovery per cent Sampled	Description
			l gy f.arg.ss.
			1" coal
			5" carb sh
M% 4.1			168'7¼" 3½" (p b c) inf coal, carb sh
V.M.% 38.6			2'0.2" (b c) coal
F.C.% 36.6			
A% 20.7	93.1		170'9" carb sh 1" (b c) coal
S% 0.58			6½" carb sh.
Joules/Gm 24410			
BTU/lb 10500			
S.G. 1.40			
			3'0.5" med gy s/ts. in places
			3½" med gy sh
			2¾" carb sh 1" bm sh
			175'7¾" 6½" carb sh.
			3" (b c) coal
M% 4.4			3" med gy sh ½" carb sh
V.M.% 40.6		Excluded	8" (b c) coal
F.C.% 44.1			2" carb sh ½" coal
A% 10.9	94.6		1'4" l gy sh 2" (p b c) coal
S% 0.65		Excluded	5½" l gy sh 1" carb sh
Joules/Gm 28380			9½" (b c) coal
BTU/lb 12210			2½" carb sh ½" dk gy sh
S.G. 1.33			180'7¾" 5½" (b c) coal
		Excluded	3.2" carb sh ½" dk gy sh.
			1¼" inf coal 6¼" (b c) coal

Overall Recovery 168'7½"–180'7¾" 94.6%

	1'4¼" l gy s/ts.
	1" carb sh 3" coal 1¼" carb sh
	1½" dk gy sh.
	med gy sh

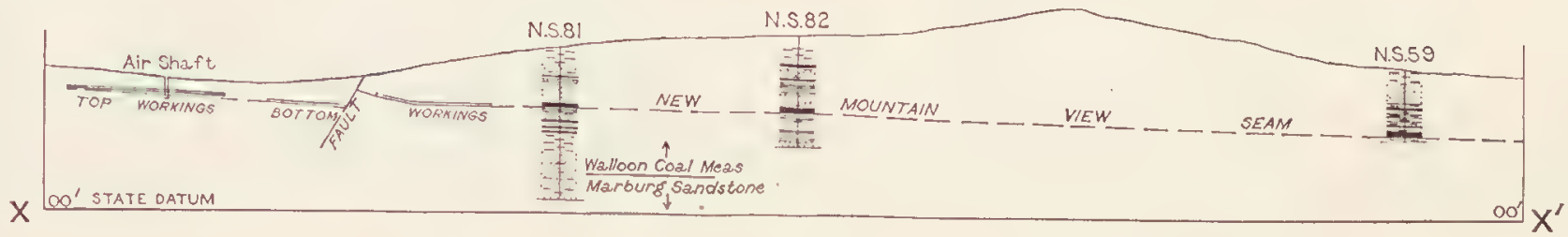
FIG.5

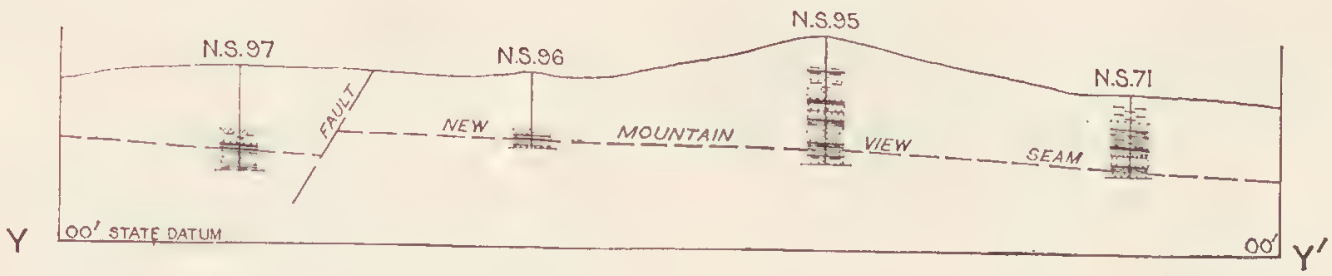
NEW MOUNTAIN VIEW MINE AREA
CROSS SECTIONS

Scale of Chains

10 8 6 4 2 0 10

N.J.H.





LEGEND

Alluvium		Iron carbonate	
Sandstone		Thin Limestone beds	
Pebbly Sandstone		Coal	
Shale		Coal with sh. bands	
Mudstone .		Shale with coal bands	
Siltstone		Basalt	

Fault Breccia

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

Only measured reserves were established by the drilling programme. These reserves which lie in the **New Mountain View Bottom seam** have been calculated in two areas—an area of 12½ acres around borehole N.S. 97 to the north of the fault and an area of 50 acres to the south embracing boreholes N.S. 81-83 and N.S. 96. The northern reserves total 70,000 tons with a weighted average ash content of 20·1 per cent. Average seam thickness is 5 ft. 1 in. including 3 ft. 2½ in. of coal. The reserves to the south of the fault total 280,000 tons with a weighted average ash content of 15·0 per cent. Seam thickness varies from 4 ft. 1½ in. to 5 ft. 7 in., the average thickness of coal being 3 ft. 4½ in.

NATURE OF COAL

The New Mountain View Bottom seam coal is of high volatile bituminous rank. Fixed carbon, calculated on a dry, mineral-matter-free basis, varies from 51·1 to 54·0 per cent. Calorific value calculated on a moist, mineral-matter-free basis varies from 13,820 to 14,220 B.Th.U. per lb. As a rule, Walloon coal is only weakly coking.

CONCLUSIONS

Because of the peculiar structural conditions obtaining, the diamond drilling in the New Mountain View area was not able to establish the precise nature of the major faulting which was then hindering colliery development. However, the programme did show that sufficient reserves of coal existed in the working seam south of the colliery to warrant the driving of a stone rise to locate the seam beyond the 50-60 ft. dislocation indicated. This work has now been completed and the coal south of the fault is being actively exploited. Measured reserves in this area amount to 280,000 tons. Although the workings to the north of the fault have now been abandoned it is estimated that measured reserves to the east of the old workings total 70,000 tons. This coal could now be best won from United No. 7 Colliery where the section being exploited includes both the New Mountain View Top and Bottom seams (see N.S. 89, fig. 3).

REFERENCE

CAMERON, J. B., 1962: Coal resources—Rosewood-Walloon coalfield (United No. 8 mine area). *Qld Govt Min. J.*, *63*, 125-137.

29th March, 1960.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(UNITED No. 7 MINE AREA)

By J. B. CAMERON

SUMMARY

Departmental diamond drilling in this area in 1957 comprised five holes totalling 1,646 ft. 6 in.

As a result, correlation of the seam succession in the area has now been firmly established.

Drilling has also shown the area to be intersected by the easterly continuation of the major fault met in the New Mountain View area. This fault divides the area in which reserves have been proved in the United No. 7 Bottom seam.

In 19 acres to the north of the fault and east of the workings, reserves amount to 157,000 tons. Working thickness averages 7 ft. including 5 ft. of coal with an estimated 12.9 per cent. ash.

To the south of the fault, the working section ranges from 7 ft. 7 in. to 9 ft. including an average 5 ft. 7 in. of coal carrying 16.1 per cent. ash. Reserves total 218,000 tons.

In addition to the above, totalling 375,000 tons, some 30,000 tons is being exploited to the north of the fault and west of the workings, in spite of the high proportion of stone to coal.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

As part of the Department of Mines' programme of coal exploration in the Rosewood district, diamond drilling of the United No. 7 mine area was carried out from May to August, 1957. During this period, five holes, N.S. 89-93, were drilled by the Department's Sullivan 22 H.D. Nos. 1 and 2 plants, the total footage being 1,646 ft. 6 in. Overall core recovery was 90·7 per cent. However, due to poor recovery in the topmost seam in borehole N.S. 89, a second shallow hole, N.S. 90, was drilled at that site.

The procedure followed in the sampling and analysis of workable coal sections was similar to that previously described for the adjacent New Mountain View mine area (Cameron, 1963). Seam correlation is based on geological work carried out by W. L. Hawthorne, Assistant Geologist, in 1951, and the writer since 1957.

The report is accompanied by the following plans, sections and diagrams:—

(*a*) Plan showing positions of boreholes, extent of mine workings, surface contours at 20 ft. intervals and underground levels on State Datum, and boundary of measured reserves; together with Locality Map—fig. 1.

(*b*) Generalised bore sections—fig. 2.

(*c*) Diagrams of seams showing sections analysed and results—United No. 8 Top and United No. 7 Top seams—fig. 3; United No. 7 Bottom seam—fig. 4.

(*d*) Cross-section—fig 5.

MINE WORKINGS

United No. 7 Colliery is situated 35 chains east-south-east of Tallegalla Railway Station and 3 miles north-north-west of Rosewood. The workings lie within Coal Mining Lease No. 391 held by United Collieries Pty. Ltd. (see Locality Map—fig. 1).

Operations commenced at United No. 7 Colliery in 1942 with the reopening of an old tunnel first driven in 1931 by W. Cowell. Coal had previously been produced here in 1933-34 and 1937, when the workings were known as Tallegalla and Glassenbury Collieries respectively. Although an attempt was made in 1937 to open up an upper seam 14 chains to the south of the existing tunnel (see fig. 1) the entire production of this mine area until 1948 came from the one seam—the United No. 7 Top seam. These workings were then abandoned and the access tunnel driven to intersect another seam some 60 ft. below. Since 1949 all coal won has come from this United No. 7 Bottom seam.

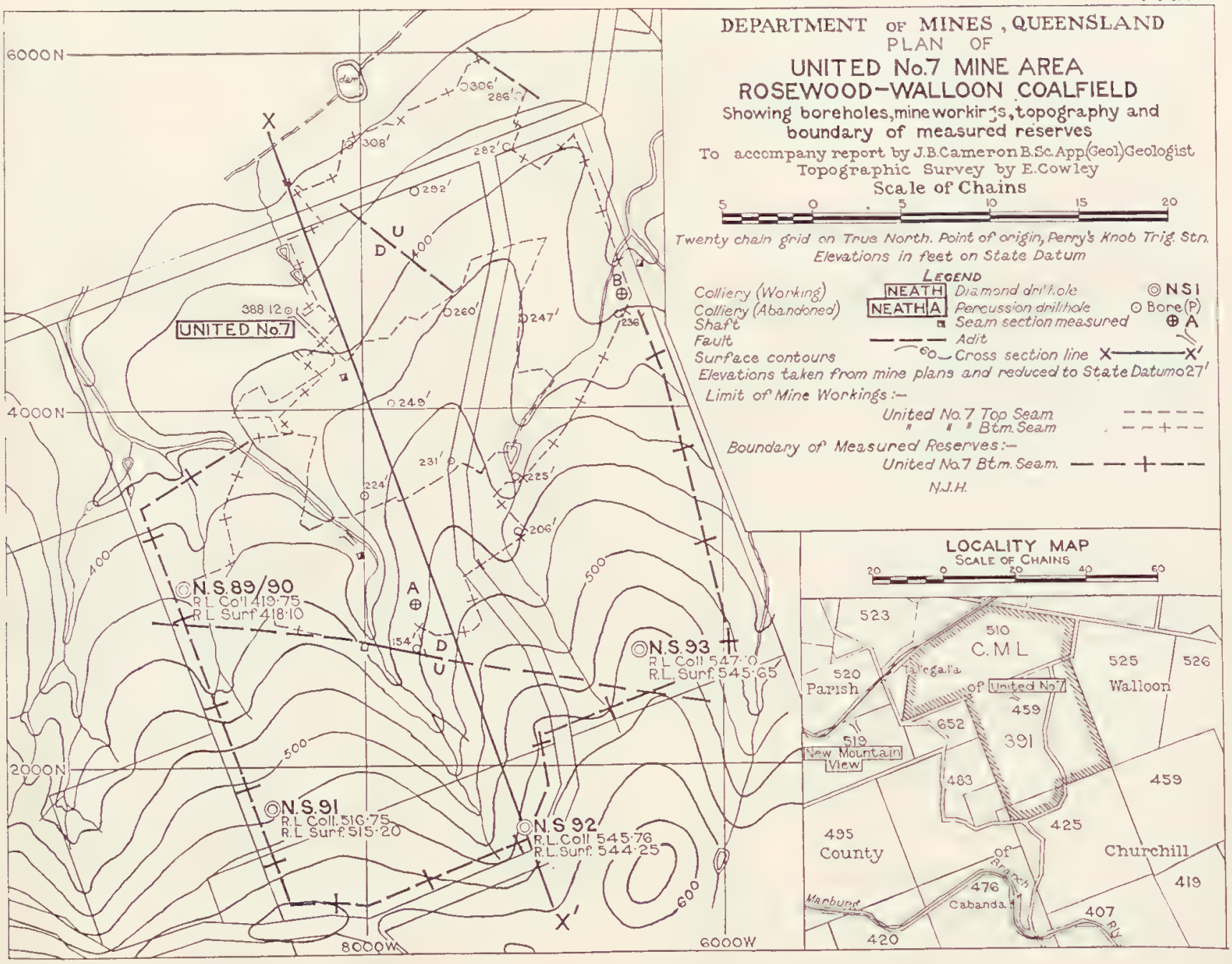
GENERAL GEOLOGY

Although some 300 ft. of Walloon Coal Measures outcrop in the United No. 7 mine area, surface exposures of these Jurassic rocks are extremely poor. Consequently reliable stratigraphic information can be gained only from subsurface investigation.

SUBSURFACE GEOLOGY

Towards the top of the Jurassic succession as developed in the Perry's Knob area of the Rosewood Coalfield there occurs a readily recognisable sequence of coal-bearing strata usually about 50 ft. thick. These beds were termed the **Rosewood seams** by Reid (1922) and have recently been described more fully by Cameron (1959, 1961*a* and *b*). This group of seams which includes in places four productive horizons is separated by about 80 ft. of sandstone and shale from the underlying **New Malabar seam.** Although removed by erosion over the greater part of the United No. 7 mine area, this upper part of the succession has been preserved as a small remnant in the vicinity of boreholes N.S. 92-93 (see fig. 2). However, because of their restricted extent and high proportion of shale bands, the seams in this section are of no commercial interest.

FIG. 1



The highest seam in the succession which was encountered in all boreholes lies approximately 60 ft. below the New Malabar seam, the intervening strata being sandstone, siltstone and shale with a few thin coal plies. This seam can be readily correlated on stratigraphic grounds with the **United No. 8 Top seam** (Cameron 1962). Workable sections exist in this seam in the United No. 7 area around boreholes N.S. 90 and N.S. 93 (see fig. 3). As in other parts of the coalfield, the seam is in places split into "tops" and "bottoms" by as much as 9 ft. of sandstone and shale. The persistent coal ply which overlies the seam elsewhere at intervals of up to 14 ft. is also developed here; it ranges in thickness from 18 in to 3 ft. and occurs only 2-3 ft. above.

Workable coal was penetrated in the **United No. 7 Top seam** only in borehole N.S. 91, the section there being 5 ft. 4 in. thick including 1 ft. 1½ in. of shale in 5 bands (see fig. 3). In the other boreholes, the seam had a thickness of approximately 5 ft. but contains numerous bands of carbonaceous and fawn shale. Because of its characteristic seam section and stratigraphic position (26-44 ft. below the United No. 8 Top seam), the United No. 7 Top seam can be correlated with the United No. 8 Bottom seam (Cameron 1962).

The **United No. 7 Bottom seam** lies 60-70 ft. below the United No. 7 Top seam, the intervening strata being mainly sandstones with three persistent but unworkable coal seams in the top 20-30 ft. In all but the south-western workings of United No. 7 Colliery, the Bottom seam is split into two sections by as much as 2 ft. of grey shale. The top section as exposed in the access tunnel is 4 ft. 9 in. thick with 6 in. of light coloured, waxy shale 2 ft. 4 in. from the top. The bottom part of the seam which alone was exploited until recent years is approximately 7 ft. thick and comprises four sections of coal separated by three persistent bands of stone which are termed locally the "bluey", "brushing" and "double" bands. In the south-western part of the colliery, however, the shale between the "tops" and "bottoms" of the seam thins to only a few inches; there the working section includes the lower 2 ft. coal ply of the "tops" as well. Similar sections, approximately 9 ft. thick were penetrated in boreholes N.S. 89 and

N.S. 92 (see fig. 4). The two sections of the seam are together also in the vicinity of borehole N.S. 91 but the working section there is reduced to 7 ft. 7 in. due to thickening of the lower member of the "double" band and deterioration of the coal below. In the eastern part of the area drilled, around borehole N.S. 93, only the "bottoms" of the seam are workable, there being over 2 ft. of interbedded sandstone and shale between the two sections.

In the adjacent New Mountain View mine area, the United No. 7 Bottom seam is represented by the New Mountain View Top and Bottom seams, the shale between the two coal horizons being equivalent to the "bluey" band of the United No. 7 area. As a result of correlations already established by the New Mountain View drilling programme (Cameron 1963), that part of the United No. 7 Bottom seam above the "bluey" band can be correlated with the Lowfield seam, a characteristic feature of which is the presence of a light coloured, waxy shale band near the roof. Such a band is evident in the "tops" of the United No. 7 Bottom seam at all observation points in this part of the Coalfield except boreholes N.S. 92-93. Its absence there is undoubtedly due to contemporaneous erosion, for in those holes, in contrast with the other points of observation, the Lowfield seam has a sandstone roof.

Immediately beneath the United No. 7 Bottom seam in borehole N.S. 89 there is a further succession of coal and thin shale bands almost 7 ft. thick but split by a median, 16 in. band of grey shale. In the other boreholes, however, this seam is represented by only a few thin coal plies separated by several feet of shale and sandstone.

In boreholes N.S. 89 and N.S. 91-92, coal-bearing strata were encountered for up to 120 ft. below the

FIG. 2

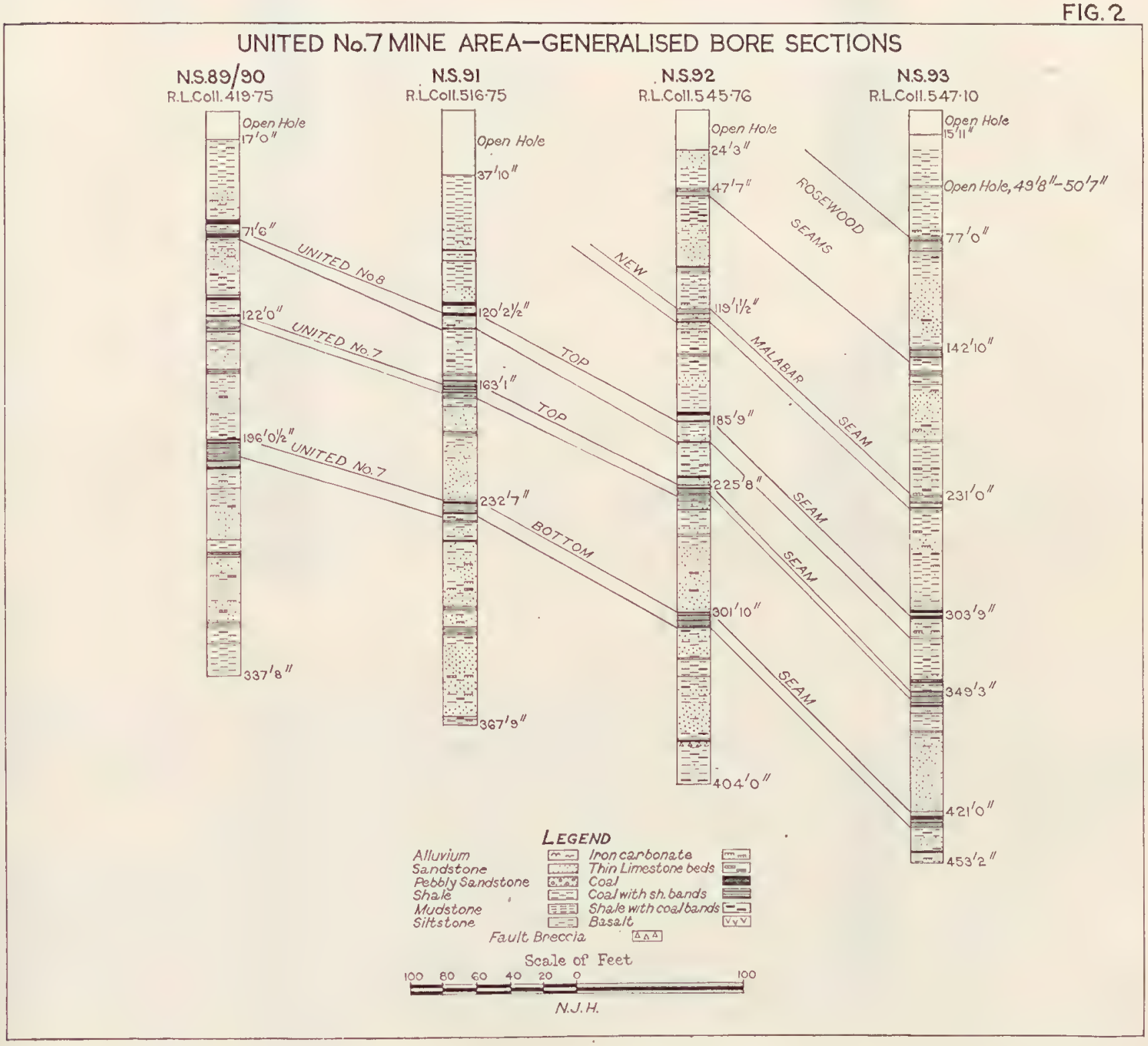
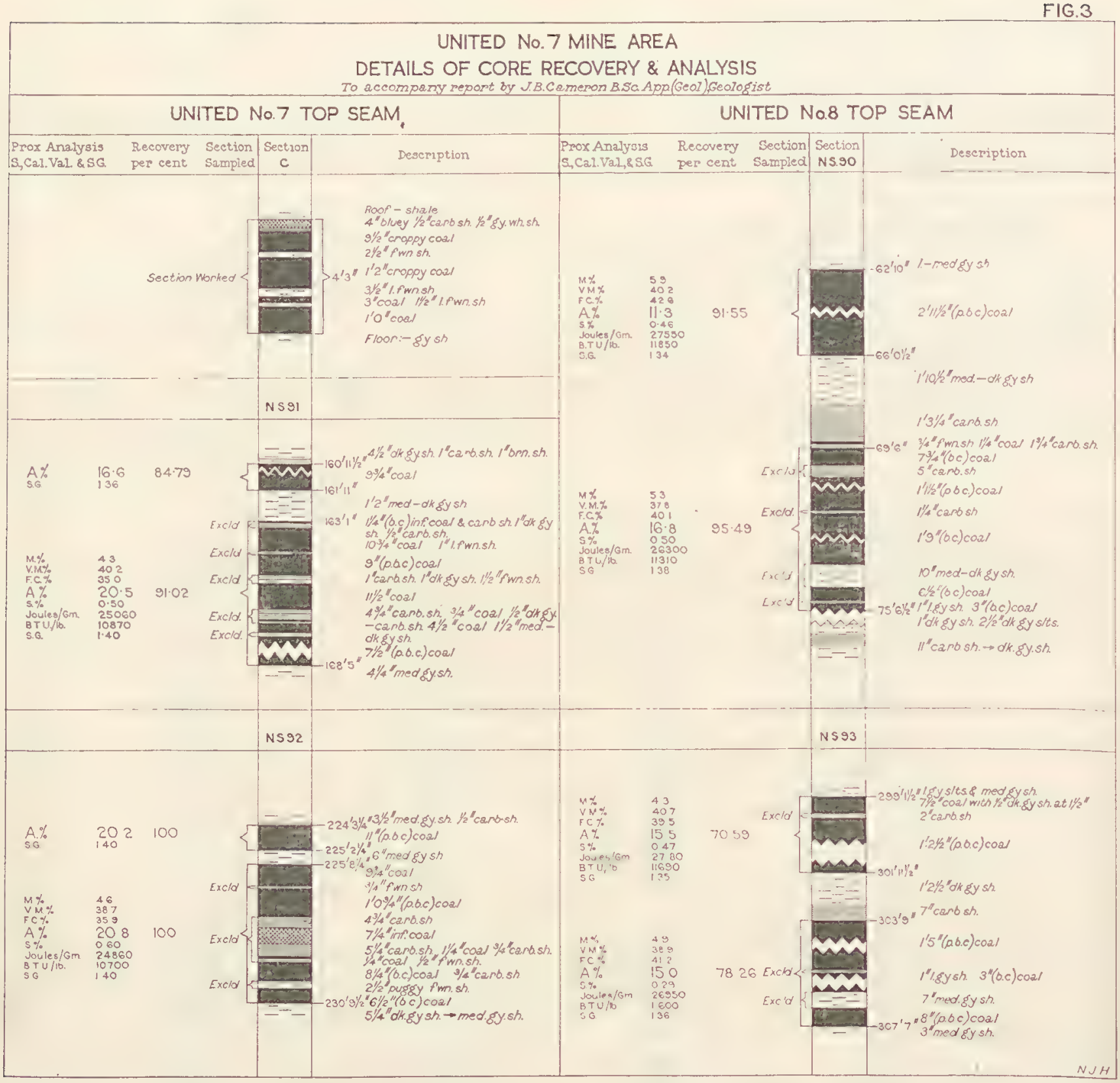


FIG.3



United No. 7 Bottom seam. With the exception of the seam just mentioned, none of the coal seams in this part of the succession is of economic interest. Such is the case also in the adjacent New Mountain View mine area (Cameron, 1963); there, almost 100 ft. below the last seam encountered, the Walloon Coal Measures are underlain with apparent conformity by the **Marburg Sandstone** which outcrops about 2 miles to the north of the United No. 7 Colliery.

STRUCTURAL GEOLOGY

When drilling commenced in the United No. 7 mine area, no major faulting had been encountered in the colliery workings. Its presence, however, was suspected ahead of the cross-dip along which the grade of the seam had increased from 1 in 18 to 1 in 8. Furthermore, half a mile to the west in the New Mountain View mine area, an east-west trending fault with an upthrow of some 60 ft. to the south had already been encountered. As a result of the drilling programme, the continuation of this fault across the United No. 7 area was established.

Since then, the workings of United No. 7 Colliery have been extended to meet the fault beyond which almost horizontal sandstones and shales have been exposed in a short stone drive (see fig. 1). At this point the fault plane strikes almost east-west and dips northwards at 55 degrees. The cross-section XX′ (see fig. 5) indicates that, at a point two chains to the east of the intersection of the cross-dip and the fault, the United

FIG. 4

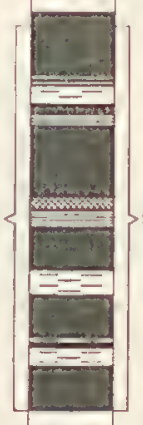
UNITED No.7 MINE AREA

DETAILS OF CORE RECOVERY & ANALYSIS

UNITED No.7 BOTTOM SEAM

To accompany report by J.B.Cameron B.Sc.App(Geol.),Geologist

N.J.H.



Section worked

Prox.Analysis S,Cal.Val & S.G.	Recovery per cent	Section Sampled	Section A	Description
				Roof:– bentonitic sh.
				1'6" coal
				1" med gy sh. 1" coal ½" med gy sh ¾" coal 5" med gy.sh. 3" coal 2½" carb.sh. ¾" med gy.sh.
				1'8" coal
				9'1½" 4" bluey ½" coal 4½" carb. sh.
				1'0" coal
				7" gy sh.
				1'0" coal
				1" gy sh. 2" coal 5" gy sh.
				1'1" coal
				Floor:– Shale

Prox Analysis S,Cal.Val.& S.G.	Recovery per cent	Section Sampled	Section B	Description
				4" coal
				6" dk.gy.sh. 3" fwn.sh.
				9" coal
				¾" gy.sh.
				7½" coal
				6" dk.gy.sh. → carb.sh.
				6" coal 2" dk.gy.sh.
				7'6¼" 11" coal
				10" gy.sh.
				8" coal
				1" gy.sh. 2" coal
				7" gy.sh.
				1'5" coal

N.S.89

				1'9" med.gy.sh.
				7¼" coal
				3¼" carb.sh. 3¾" coal
				¾" carb.sh.– dk.gy.sh. 5¼" fwn.
				198'3½" bent.sh. ¾" (b.c.) inf. coal 1½" carb. sh. ½" coal ¾" carb.sh. ½" coal ½" inf.coal 7¼" (p.b.c.) coal ½" carb.sh.
		Excluded		4½" (p.b.c.) coal ½" carb.sh. ¾" (b.c.) coal 2" carb.sh. 6" (b.c.) coal
		Excluded		1¼" carb.sh. 1" med.gy.sh. 2¼" (p.b.c) carb.sh. ¾" dk.gy.sh. 1¼" carb.sh.
				¾" fwn.sh. ¾" (p.b.c) carb. sh.
				7" (p.b.c) coal
M% 4·5		Excluded		5½" carb. sh. 3" med.gy. sh.
V.M.% 39·8				1'0½" carb.sh.
F.C.% 41·8				1¾" (p.b.c) coal ¾" dk.gy–carb.sh.
A.% 13·9	85·87	Excluded		11" coal (p.b.c.) in btm. 6"
S% 0·51				1¾" med.gy. sh. ½" carb.sh.
Joules/Gm 27940				1'1" coal (b.c.) in btm. 5½"
B.T.U./lb. 12020		Excluded		1¼" l.gy.sh. 1¾" (b.c.) coal
S.G. 1·34				1" (p.b.c.) l.gy.sh.
				207'10½" 10½" coal (b.c) in top 5½"
				208'0¾" 2¼" carb.sh. 4" coal (p.b.c) btm 2"
		Excluded		3½" carb.sh. 1" coal 1½" l.gy.sh.
		Excluded		7" coal (b.c) in btm. 5¾"
M% 4·2				3¾" med. gy. sh. 4¾" (p.b.c) coal
V.M.% 37·9				1½" carb.sh.
F.C.% 41·0		Excluded		1'0¾" l.gy sh.– med. gy. sh.
A.% 16·9	100			2" dk.gy–carb.sh. 2¼" coal ½"
S% 0·57		Excluded		carb.sh. ½" dk.gy.sh. 1¾" coal
Joules/Gm. 26520		Excluded		1¼" l–med.gy sh. 4" (p.b.c) coal
B.T.U./lb. 11410		Excluded		3¼" med. gy sh. ½" inf. coal
S.G. 1·37.				2½" med.gy.sh. 4" coal 1" carb.sh.
				1" dk. gy sh. 2½" coal ½" dk.gy.sh.
				214'10½" 1'1¼" (p.b.c.) coal
				interbd. l gy slts. & med.gy sh.

N.S.92

				301'10" l.gy.f.arg.ss.
				7" coal 1" carb.sh.
		Excluded		10½" coal
		Excluded		1" fwn.sh.
				1'2½" (p.b.c) coal with 1" carb.sh. at 6"
M% 4·9				1½" (p.b.c) inf. coal 2¾" carb.sh.
V.M.% 37·1		Excluded		8" coal
F.C.% 34·6				5" carb.sh.
A.% 20·4	86·01	Excluded		8" coal (b.c.) in top 5"
S% 0·48				8" med.gy.sh. → slts.
Joules/Gm. 25290		Excluded		4¾" (b.c.) coal 1¼" boulder
B.T.U/lb 10830				¾" med.gy.sh. 3½" (p.b.c.) coal
S.G. 1·41		Excluded		4½" l.gy.slts. 5" med.gy.sh.
		Excluded		7" (b.c.) coal
				310'11" carb. sh.

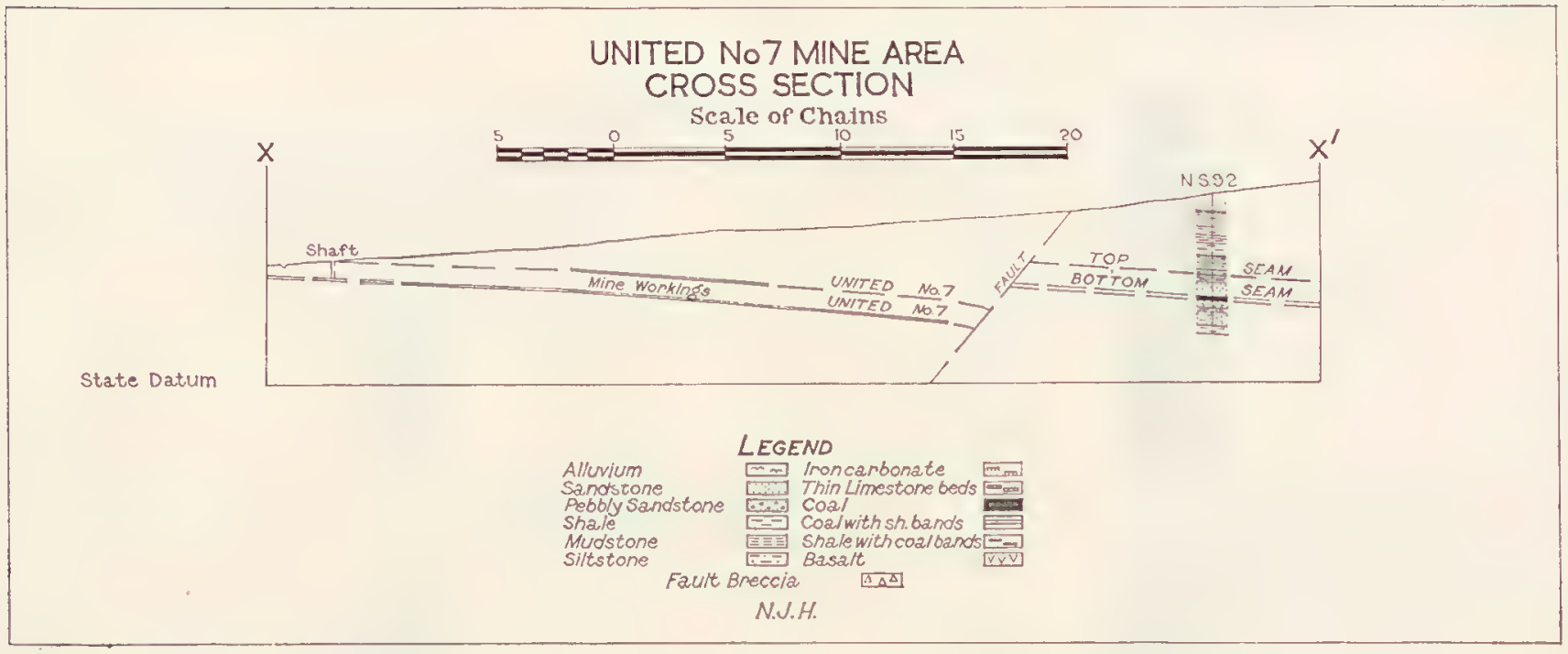
N.S.91

				l.gy.f.arg.ss.
				1¾" (b.c.) coal 1" carb.sh 1" fwn.sh
				1¼" (b.c.) coal ½" brn.sh. 1¼" carb.
				234'3¼" sh. 3¼" coal 3½" fwn. bent sh.
				1¾" carb.sh. ¾" coal. 2¾" carb. sh. 1" coal ¾" carb.sh. 1'1" coal
		Excluded		½" (p.b.c.) coal
				1¼" fwn.sh. 3¼" (p.b.c) coal
				1" dk.gy.– carb.sh 3½" (p.b.c) coal
M% 4·5				1'2¾" carb.sh. → dk gy sh with ½"
V.M.% 38·3				coal 1'0½" from top
F.C.% 39·7		Excluded		1" (p.b.c) coal 5¼" dk.gy–carb.sh
A.% 16·5	97·26			1½" (p.b.c) coal
S% 0·48				
Joules/Gm 26610				8" l.gy.slts
B.T.U./lb. 11450		Excluded		
S.G. 1·37				1'0¾" (p.b.c) coal
				241'10¼" ¾" med.gy.sh. 3¾" (b.c) coal
				¾" carb.sh.
				1'3" l.gy.sh
				1¼" (b.c.) coal 2¾" carb.sh. 1¾" fwn sh. 1" carb.sh. 5½" l.gy sh.

N.S.93

				1" med gy.sh. 1" dk gy.sh. 3" inf. coal
				424'6¾" → coal 2¼" dk.gy.sh. ½" coal 1" fwn.
				sh. 2½" (p.b.c) coal ¾" carb.sh.
		Excluded		5¾" (p.b.c) coal ½" carb.sh ¼" iron
				pyrites 1'1½" (p.b.c) coal
M% 4·5				9" carb.sh. 1" dk gy.sh. ¾" carb.sh.
V.M.% 39·4				
F.C.% 43·2		Excluded		8¾" (p.b.c) coal
A.% 12·9	96·42			3¾" med gy sh.
S% 0·61		Excluded		10½" (b.c) coal
Joules/Gm. 27830				1¼" med gy sh. 2½" coal
B.T.U/lb. 11370		Excluded		4" med.–dk.gy.sh.
S.G. 1·35				1'4" (p.b.c.) coal
				431'6½" carb. sh.

FIG. 5



No. 7 Bottom seam has been upthrown approximately 120 ft. Measured from a point three chains up the cross-dip, however, the vertical displacement of the working section is only 90 ft. This reduction is due to the steep dip of the beds north of the fault, the seam grade in the immediate vicinity of the disturbance being as much as 1 in 6.

Away from the influence of the fault, the Walloon Coal Measures have a regional dip of about 3 degrees to the south-east—the usual attitude of the beds in this part of the coalfield.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings):—

(*a*) measured reserves—up to 12½ chains.

(*b*) indicated reserves—more than 12½ chains.

The area of both indicated and measured reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

Although workable coal was penetrated in the United No. 8 Top seam in boreholes N.S. 90 and N.S. 93 and in the United No. 7 Top seam in borehole N.S. 91, measured reserves were established by the drilling programme only in the **United No. 7 Bottom seam.** These reserves have been calculated in two areas.

(1) An area of 19 acres north of the fault and east of the present workings. Average thickness of the working section here which is confined to the "bottoms" of the seam is 7 ft. including 5 ft. 0 in. of coal. Reserves total 157,000 tons with an estimated ash content of 12·9 per cent.

(2) An area of 23 acres south of the fault over the greater part of which the "tops" and "bottoms" of the seam can be worked together, resulting in a seam thickness of approximately 9 ft. Around borehole N.S. 91, however, the working section is reduced to 7 ft. 7 in. due to thickening of the lower member of the "double" band and deterioration of the coal below. Average thickness of coal in this southern area is 5 ft. 7½ in. Reserves amount to 218,000 tons, the weighted average ash content being 16·1 per cent.

In addition to the 375,000 tons of coal in the above two areas, some 30,000 tons still remain to the north of the fault west of the present workings. Because of the high proportion of stone to coal in the working section in this area (see N.S. 89, fig. 4), this tonnage is not included in the category of measured reserves although the seam here is still being exploited.

NATURE OF COAL

The United No. 7 Bottom seam coal is of high volatile bituminous rank. Fixed carbon, calculated on a dry, mineral-matter-free basis, varies from 47·42 53·07 per cent. Calorific value, calculated on a moist, mineral-matter-free basis, varies from 13,910 to 14,160 B.T.U.'s per lb. As a rule, Walloon coal is only weakly coking.

CONCLUSIONS

As a result of the drilling programme in this mine area, measured reserves were established only in the United No. 7 Bottom seam. These reserves, totalling 375,000 tons, have a weighted average ash

content of 14·8 per cent. This estimate is based on 100 per cent. efficiency in handpicking of stone both underground and on the surface and so the quality of the product finally marketed can be expected to be somewhat inferior, particularly with the coal-cleaning methods now employed at United No. 7 Colliery.

Furthermore, only about 40 per cent. of these reserves is immediately available; the remainder lies beyond a major fault which has upthrown the working seam to the south an estimated 120 ft. in the vicinity of the cross-dip. This coal could be reached with a minimum of driving by means of a stone rise commencing not at the fault intersection but some 3 chains up the cross-dip for there, because of the local structural conditions previously described, the vertical interval between the workings and the upthrown seam is only 90 ft.

REFERENCES

CAMERON, J. B., 1959: Coal resources—Rosewood-Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

————, 1961*a*: Coal resources—Rosewood-Walloon coalfield (Glencoe mine area). *Qld Govt Min. J., 62,* 93-102.

————, 1961*b*: Coal resources—Rosewood-Walloon coalfield (Oakleigh mine area). *Qld Govt Min. J., 62,* 416-427.

————, 1962: Coal resources—Rosewood-Walloon coalfield (United No. 8 mine area). *Qld Govt Min. J., 63,* 125-137.

————, 1963: Coal resources, Rosewood-Walloon coalfield (New Mountain View mine area). *Geol. Surv. Qld. Publ.,* 310, 1-8.

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

3rd June, 1960.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (ROUGHRIGG No. 5 MINE AREA)

By E. S. Chiu Chong

SUMMARY

A diamond drilling programme in the Roughrigg No. 5 mine area during 1957, 1959, *and* 1961, *consisted of eighteen holes, with a total footage of* 5,705 *ft.* 11 *in.*

Reserves have been established in two seams. In the United No. 7 *Top seam, measured reserves amount to* 250,000 *tons and indicated reserves to* 60,000 *tons. In the Roughrigg No.* 5 *working seam, measured reserves of* 600,000 *tons lie directly ahead and to the west of present workings, and* 260,000 *tons lie east of the fault encountered in the workings.*

Detailed stratigraphic correlation of the sequence has been made with that of the adjoining Oakleigh and United No. 7 *areas, and the occurrence of two major faults in the area has been indicated.*

INTRODUCTION

The Roughrigg No. 7 mine area which lies to the south-east of Roughrigg No. 5 mine area, was tested by eight diamond drill holes, N.S. 2-9, in 1952. The results of this programme have been published in a report by Hawthorne (1954).

During the testing of the United No. 7 mine area, directly to the west, in 1957, two diamond drill holes, N.S. 94 and N.S. 98, were drilled by the Department of Mines in the Roughrigg No. 5 mine area. In February, 1959, a third hole, N.S. 150, was drilled. To complete the diamond drilling programme in this mine area, an additional fifteen holes, N.S. 232-246, were drilled during the period July-December, 1961. Footage for the eighteen holes totalled 5,705 ft. 11 in., of which 3,699 ft. 5 in. were cored. Overall core recovery was 97 per cent., recovery in target coal seams being 95 per cent.

This report is accompanied by the following plans, sections and diagrams:—

(*a*) Locality Map—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, underground levels and surface contours at 20 ft. intervals on State Datum, and boundaries of reserves—fig. 2.

(*c*) Generalised bore sections—fig. 3.

FIG. 1

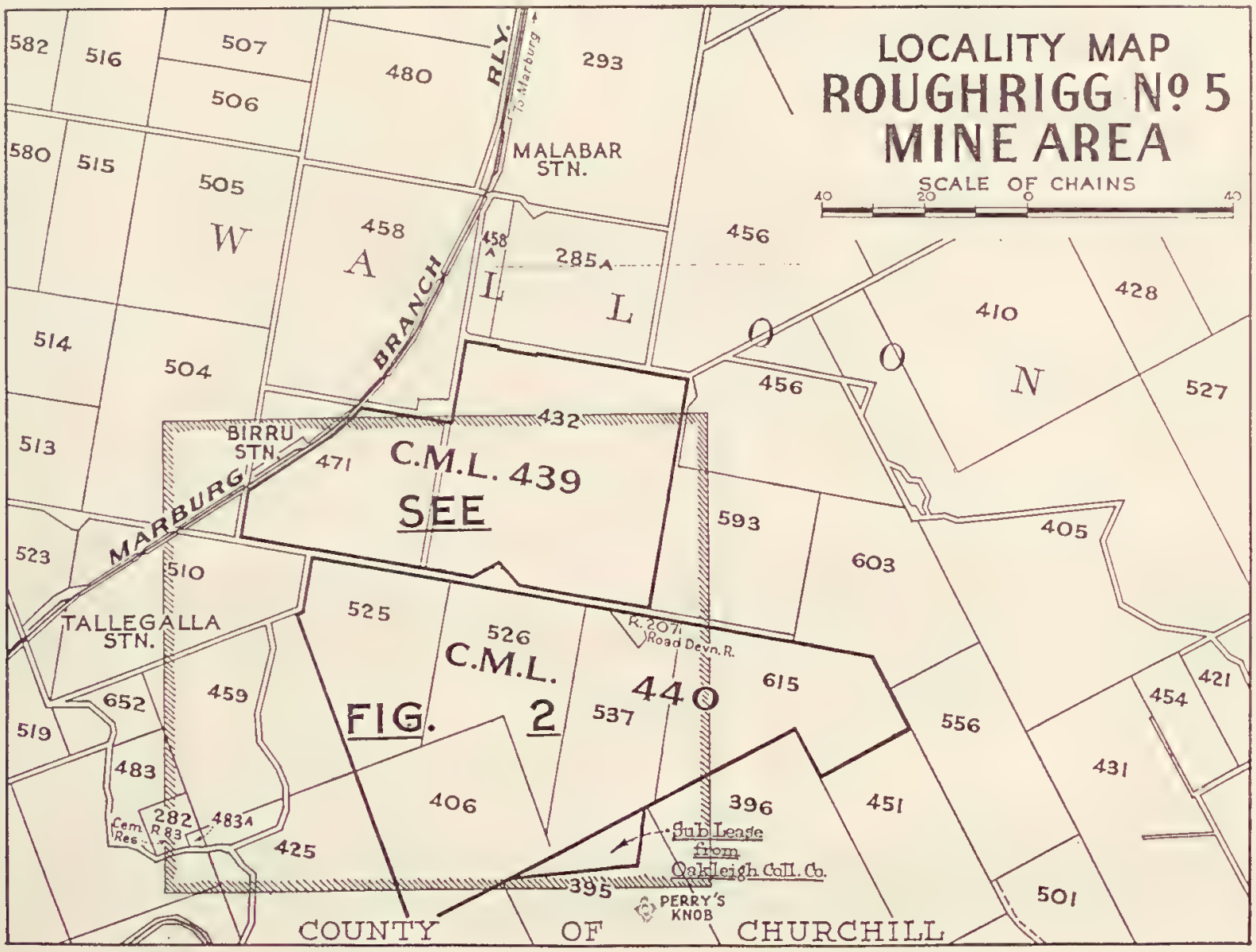


FIG. 2

ROUGHRIGG No.5 MINE AREA

ROSEWOOD - WALLOON COALFIELD

Showing boreholes, topography, mine workings & reserves

To accompany report by E.S.Chiu Chong, B.Sc., Geologist

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10

SURVEY DATA

Twenty chain grid on True North at point of origin — Perrys Knob Trig. Stn.
Elevations in feet on State Datum. Survey by Ewan Cowley, Asst. Surveyor.

LEGEND

- Wkgs on Roughrigg Top Seam
- Wkgs on Roughrigg Bottom Seam
- Wkgs on New Malabar Seam
- Wkgs on United No.7 Top Seam
- Wkgs on Roughrigg No.5 wkg. Seam
- Adit — Shaft
- Wkg Colly. MINE — Aband. Colly. MINE
- Diamond D'hole — Section line A—A
- Seam Section Measured
- Measured Reserves on United No.7 Top seam
- Indicated Reserves on United No.7 Top seam
- Measured Reserves on Roughrigg No.5 working seam
- Fault — Uground level 741'

ROUGHRIGG No. 5
MOUNTAIN ASH No.1 A
UNITED No.7
ROSEMOUNT No.1 A
ROUGHRIGG No.7
ROUGHRIGG No.6 A
ROUGHRIGG No.4 A
No.2 A
ROUGHRIGG No.1 A
No.3 A

N.S.94 RL COLL 3838 RL SURF 3826
N.S.150 RL COLL 4080 RL SURF 4056
N.S.98 RL COLL 4080 RL SURF 4070
N.S.234 RL COLL 4635 RL SURF 4615
N.S.235 RL COLL 4843 RL SURF 4813
N.S.236 RL COLL 4675 RL SURF 4661
N.S.237 RL COLL 5421 RL SURF 5403
N.S.240 RL COLL 4633 RL SURF 4618
N.S.6 RL SURF 4937
N.S.239 RL COLL 5194 RL SURF 5178
N.S.238 RL COLL 6067 RL SURF 6041
N.S.5 RL SURF 6332
N.S.89-90 RL COLL 4198 RL SURF 4181
N.S.93 RL COLL 5471 RL SURF 5457
N.S.232 RL COLL 4879 RL SURF 5867
N.S.2 RL SURF 5904
N.S.3 RL SURF 6509
N.S.4 RL SURF 6809
N.S.9 RL SURF 7567
N.S.91 RL COLL 5168 RL SURF 5152
N.S.92 RL COLL 5458 RL SURF 5443
N.S.233 RL COLL 5982 RL SURF 5872
N.S.7 RL SURF 7075
N.S.8 RL SURF 7442
N.S.241 RL COLL 4541 RL SURF 4521
N.S.242 RL COLL 3861 RL SURF 3867
N.S.243 RL COLL 4397 RL SURF 4382
N.S.244 RL COLL 4013 RL SURF 4072
N.S.245 RL COLL 4395 RL SURF 4375
N.S.246 RL COLL 5187 RL SURF 5167

APPROX. TRACE OF LOWFIELD SEAM

471 525 526 459 483 483A 425 282 R.83 537 615 593 456 406 396 R 207

8000 N 6000 N 4000 N 2000 N
8000 W 6000 W 4000 W 2000 W

(*d*) Diagrams of United No. 7 Top seam (fig. 4), and Roughrigg No. 5 working seam (fig. 5), showing sections analysed and results.

(*e*) A correlation diagram of Roughrigg No. 5 working seam—fig. 6.

(*f*) Three cross-sections—fig. 7.

All workable coal sections encountered in the drilling programme were examined by an Engineer Member of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product which could be marketed after handpicking of stone both underground and on the surface. However, a jig-type washing plant is at present being installed by the colliery management. All analyses were carried out by the Government Chemical Laboratory.

MINE WORKINGS

The mine area, comprising Coal Mining Leases Nos. 439 and 440, lies three miles north of Rosewood, and a half-mile east of Birru Railway Station. These leases are held by the Cochrane family trading as Roughrigg Colliery. South of C.M.L. No. 440, an additional area in the Roughrigg No. 7 working seam has been subleased from Oakleigh Colliery Coy., holders of C.M.L. No. 387. This sublease is shown on fig. 1.

Of the five seams which have been exploited in the area, only two, some 260 ft. stratigraphically apart, are now being worked. Roughrigg No. 5 Colliery works the lower, and Roughrigg No. 7 works the higher of these seams. In addition to these two producing pits, there are several abandoned ones in the area. These are Roughrigg Nos. 1-4, and No. 6, Rosemount No. 1 and Mountain Ash No. 1.

Operations in Roughrigg No. 5 Colliery commenced in 1955. Development to the east has been stopped by a major fault. Workings along this eastern margin are now inaccessible. As workings extended to the west and south, the interval between the worked section and the underlying coal and shale bands decreased, and the section now worked includes some of these underlying coal bands as well as the original section.

Roughrigg No. 7 Colliery was opened in 1951. The working seam lies near the base of a succession of coal and shale bands 40-50 ft. thick, and is known locally as the Roughrigg Bottom seam. This seam, as well as the Roughrigg Top seam, had been exploited from the abandoned Roughrigg adits. Diamond drilling by the Department of Mines had previously been carried out to test these seams.

GENERAL GEOLOGY

The coal-bearing strata form part of the Walloon Coal Measures of Jurassic age. As the rocks of this formation contain a high percentage of clay, outcrops are rare. Unconformably overlying these measures, in some places, are Tertiary basalts with associated sediments.

The area drilled is situated on the northern slopes of a long ridge which culminates at Perry's Knob. Roughrigg No. 5 Colliery lies at the base of these slopes. Only in the southern part of the area, where it is preserved by Tertiary basalt, does the full succession of coal-bearing strata occur. At the foot of the ridge, in the northern part of the area, the top 300 ft. have been eroded away.

SUBSURFACE GEOLOGY

Hawthorne (1954) described the geology of the Jurassic succession penetrated by previous departmental drilling in the area in 1952.

Boreholes, N.S. 232-233, drilled in the south of the area, were the only holes of the present programme which cored the 40-50 ft. of coal bearing strata occurring at the top of the productive beds. The **Roughrigg Top and Bottom seams** which lie within this section are now known to represent part of the **Rosewood seams** first described by Reid (1922). They are correlated on stratigraphic and lithological grounds with the Oakleigh Nos. 1 and 3 seams respectively, previously described in detail by Cameron (1961). No workable section within this sequence was obtained in these two holes.

The seam occurring at 57 ft. 11 in. in N.S. 236, which was drilled near the abandoned and inaccessible Rosemount No. 1 Colliery, is believed to be the seam worked in that mine. It is tentatively correlated with the **New Malabar seam** on stratigraphic grounds, and lies some 70 ft. below the Roughrigg Bottom seam in this area. No workable section was obtained in any of the holes which cored this seam, which is represented in most cases by interbeds of carbonaceous and grey shale with minor coal. It was tested in the Roughrigg No. 7 mine area also without success.

Lying 50-70 ft. lower is a seam which is correlated on stratigraphic grounds with the **United No. 8 Top seam.** It was cored during the testing of the Roughrigg No. 7 area, but no workable section was encountered in that programme. In the present series of holes, the only workable section was obtained in the "tops" in N.S. 234. Coal deterioration and splitting within the "tops" occurred in the other holes. The minimum interval between "tops" and "bottoms" was 2 ft. 8 in., occurring also in N.S. 234.

In the United No. 7 mine area, the **United No. 7 Top seam** lies 30-40 ft. below the United No. 8 Top seam (Cameron, 1963). The interval is fairly consistent in the subject area, although it has increased to 60 ft. in N.S. 98, and has decreased to less than 20 ft. in N.S. 236, N.S. 238, and N.S. 241. The intervening strata are sandstone and shale with two

FIG. 3A

ROUGHRIGG No 5
GENERALISED BORE SECTIONS

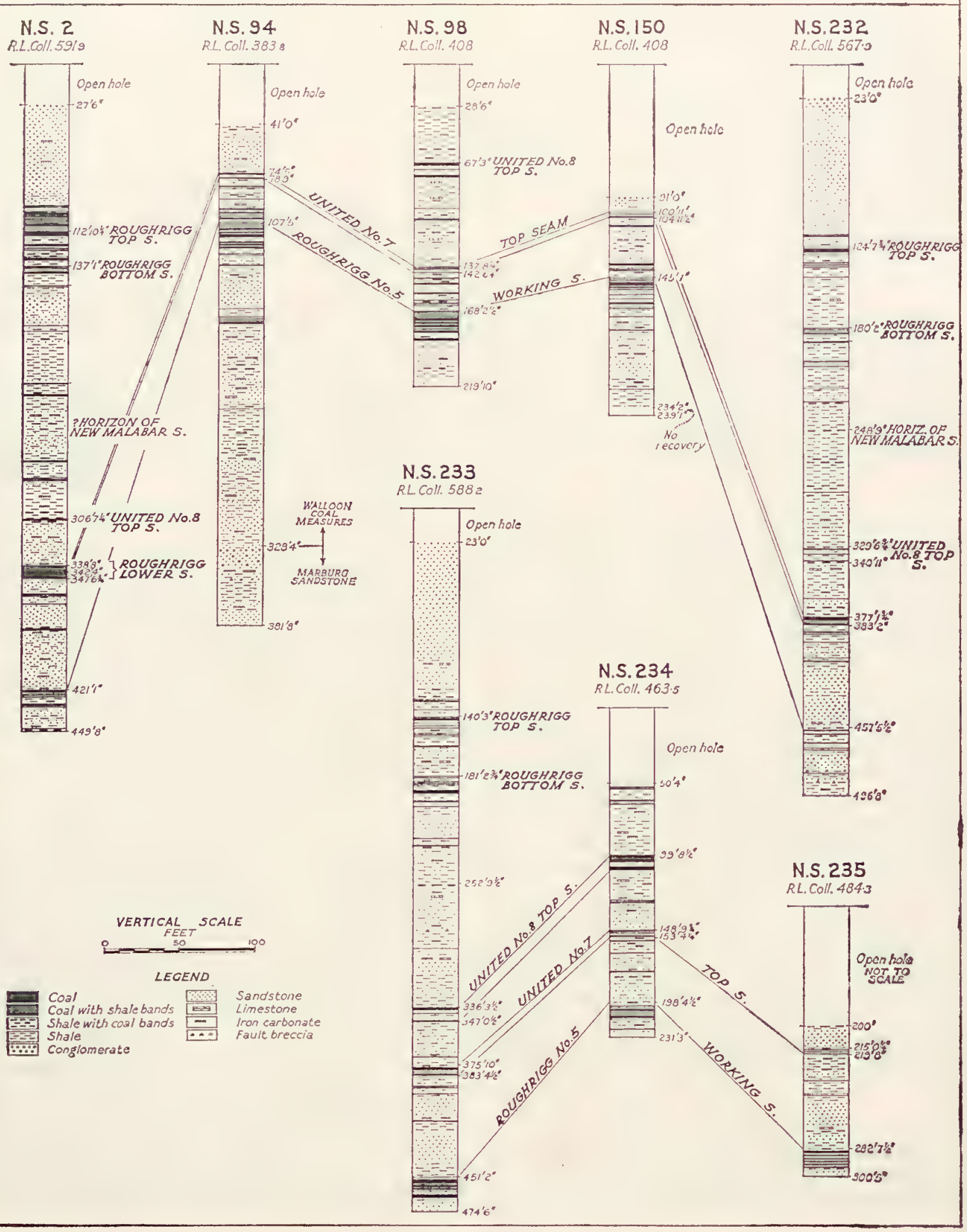
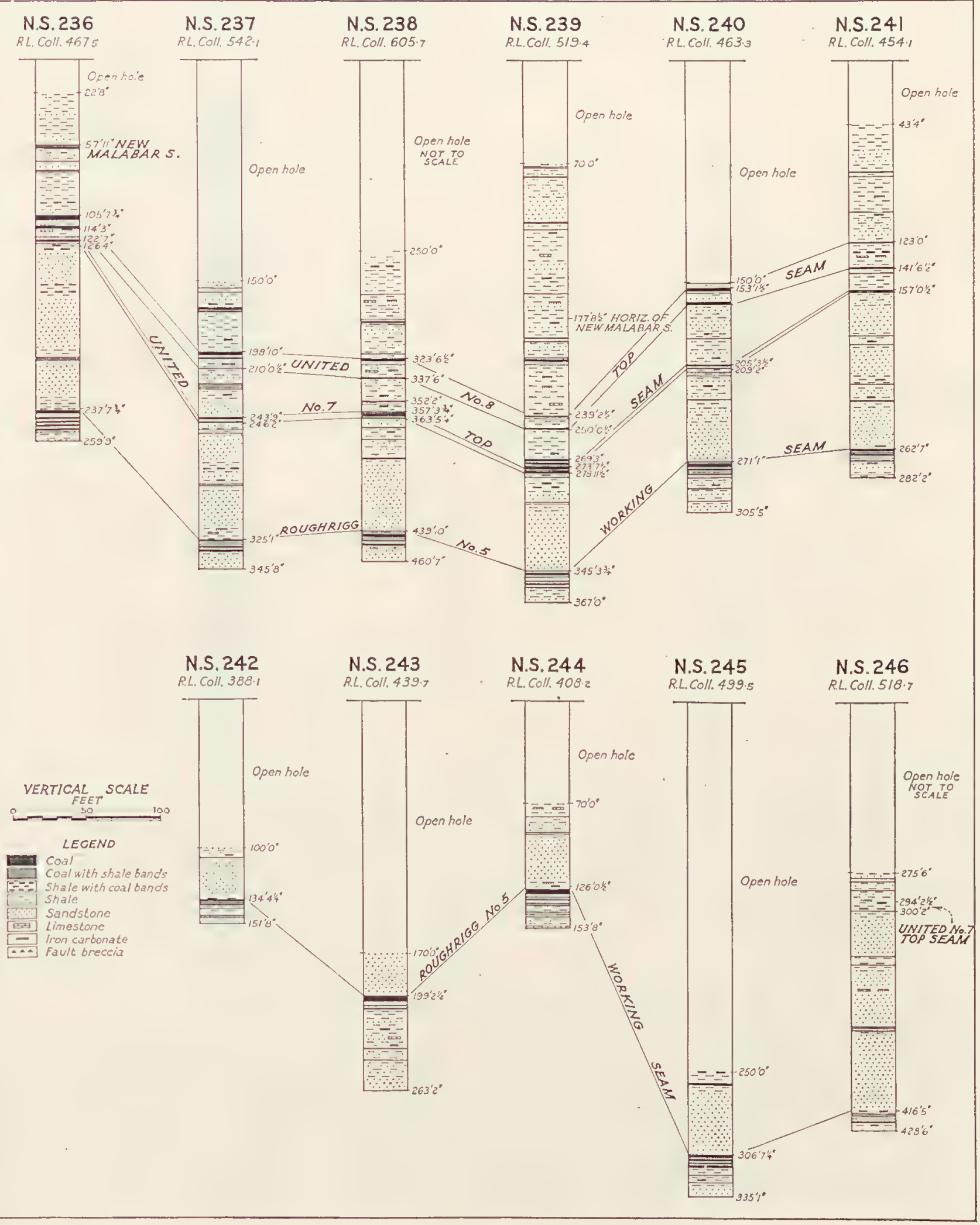


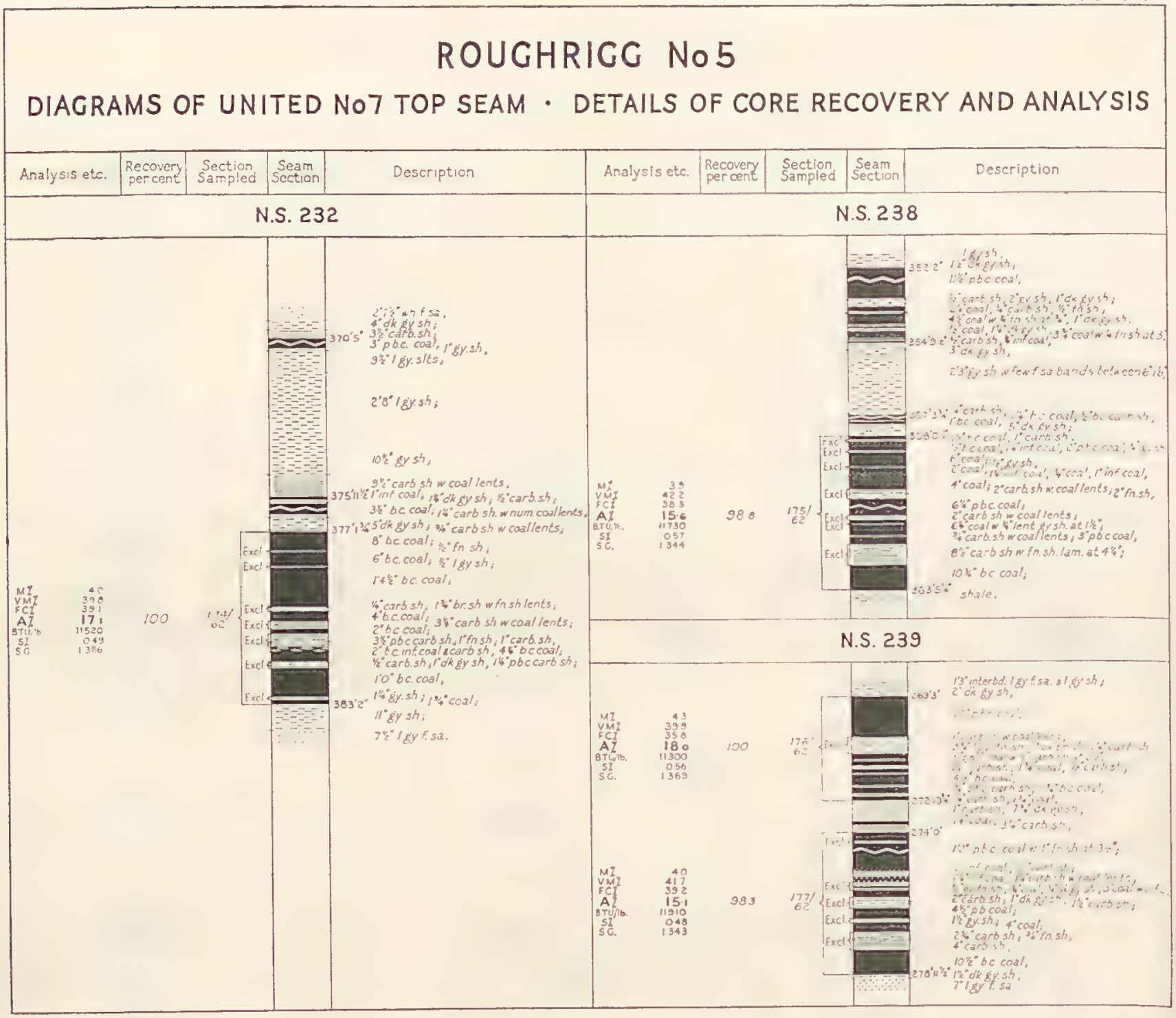
FIG. 3B

ROUGHRIGG No 5
GENERALISED BORE SECTIONS



C

FIG. 4


ROUGHRIGG No 5
DIAGRAMS OF UNITED No 7 TOP SEAM · DETAILS OF CORE RECOVERY AND ANALYSIS
Analysis etc.
Recovery per cent
Section Sampled
Seam Section
Description
N.S. 232
MI 4·0
VMI 39·8
FCI 39·1
Ash 17·1
BTU/lb. 11520
SI 0·49
SG 1·386
100
370'5" 3½" carb.sh; 3" p.b.c. coal, 1" gy.sh, 9½" l gy. slts;
2'8" l gy.sh;
10½" gy sh;
375'11½" 1" inf coal; 1⅝" dk gy sh; ½" carb.sh;
3½" b.c. coal; 1¼" carb sh. w num. coal lents;
377'1¾" 5" dk gy sh; ¾" carb sh w coal lents;
8" b.c. coal; ½" fn sh;
6" b.c. coal; ½" l gy sh;
1'4½" b.c. coal;
¼" carb.sh; 1¾" br.sh w fn sh lents;
4" b.c. coal; 3¼" carb sh w coal lents;
2" b.c. coal;
3½" p.b.c carb sh; 1" fn.sh; 1" carb.sh;
2" b.c. inf coal & carb sh; 4½" b.c coal;
½" carb.sh; 1" dk gy sh; 1¼" p.b.c carb sh;
1'0" b.c. coal;
383'2" 1¼" gy.sh; 1¾" coal;
11" gy sh;
7½" l gy f.sa.
N.S. 238
MI 3·9
VMI 42·2
FCI 38·3
Ash 15·6
BTU/lb. 11730
SI 0·57
SG 1·344
98·8
352'2" 1 gy sh;
1½" dk gy sh;
1½" p.b.c coal;
½" carb sh; 2" gy sh; 1" dk gy sh;
½" coal; ¼" carb sh; ½" fn sh;
4½" coal w ¼" fn sh at 2"; 1" dk gy sh.
½" coal; 1¼" dk gy sh;
354'9" ½" carb sh; ¼" inf coal; 3¾" coal w ¼" fn sh at 3";
3" dk gy sh;
2'3" gy sh w few f sa bands between 6" to
357'3¼" 4" carb sh; 1¼" b.c coal; ½" b.c coal sh;
1" b.c coal; 5" dk gy sh;
358'0" ¼" b.c coal; 1" carb sh;
½" b.c coal; 1" inf coal; 2" p.b.c coal; ¼" c
6" coal; ½" gy sh;
2" coal; 1¼" inf coal; ¼" coal; 1" inf coal;
4" coal; 2" carb sh w coal lents; 2" fn.sh;
6¼" p.b.c coal;
2" carb sh w coal lents;
6½" coal w ¼" lent gy sh at 1½";
¾" carb.sh w coal lents; 3" p.b.c coal;
8½" carb sh w fn.sh. lam. at 4¼";
10¾" b.c coal;
363'5¼" shale.
N.S. 239
MI 4·3
VMI 39·9
FCI 35·8
Ash 18·0
BTU/lb. 11300
SI 0·56
SG 1·369
100
176'6" 1'3" interbd. l gy f.sa. & l gy sh;
2" dk gy sh;
369'3"
372'10¾" 1" coal, 4" carb sh;
¾" carb.sh; 1¾" coal;
1" carb sh, 7¾" dk gy sh,
1" coal, 3¼" carb sh,
374'0"
1'0" p.b.c coal w 1" fn sh at 3";
MI 4·0
VMI 41·7
FCI 39·2
Ash 15·1
BTU/lb. 11910
SI 0·48
SG 1·343
98·3
177'6" 2" carb.sh; 1" dk gy sh; 1½" carb sh;
4½" p.b coal;
1½" gy.sh; 4" coal;
2¾" carb sh; ¾" fn.sh,
4" carb sh,
10½" b.c coal,
378'4½" 1½" dk gy sh,
1" l gy f. sa

persistent coal seams. In the southern part of the area, the lower of these coal seams lies almost directly above the United No. 7 Top seam, the interval being 6 in. in N.S. 3. Elsewhere the interval increases, being over 20 ft. in the north-western boreholes. Hence the **Roughrigg Lower seam** of Hawthorne (1954) can now be equated with the United No. 7 Top seam plus the overlying coal seam.

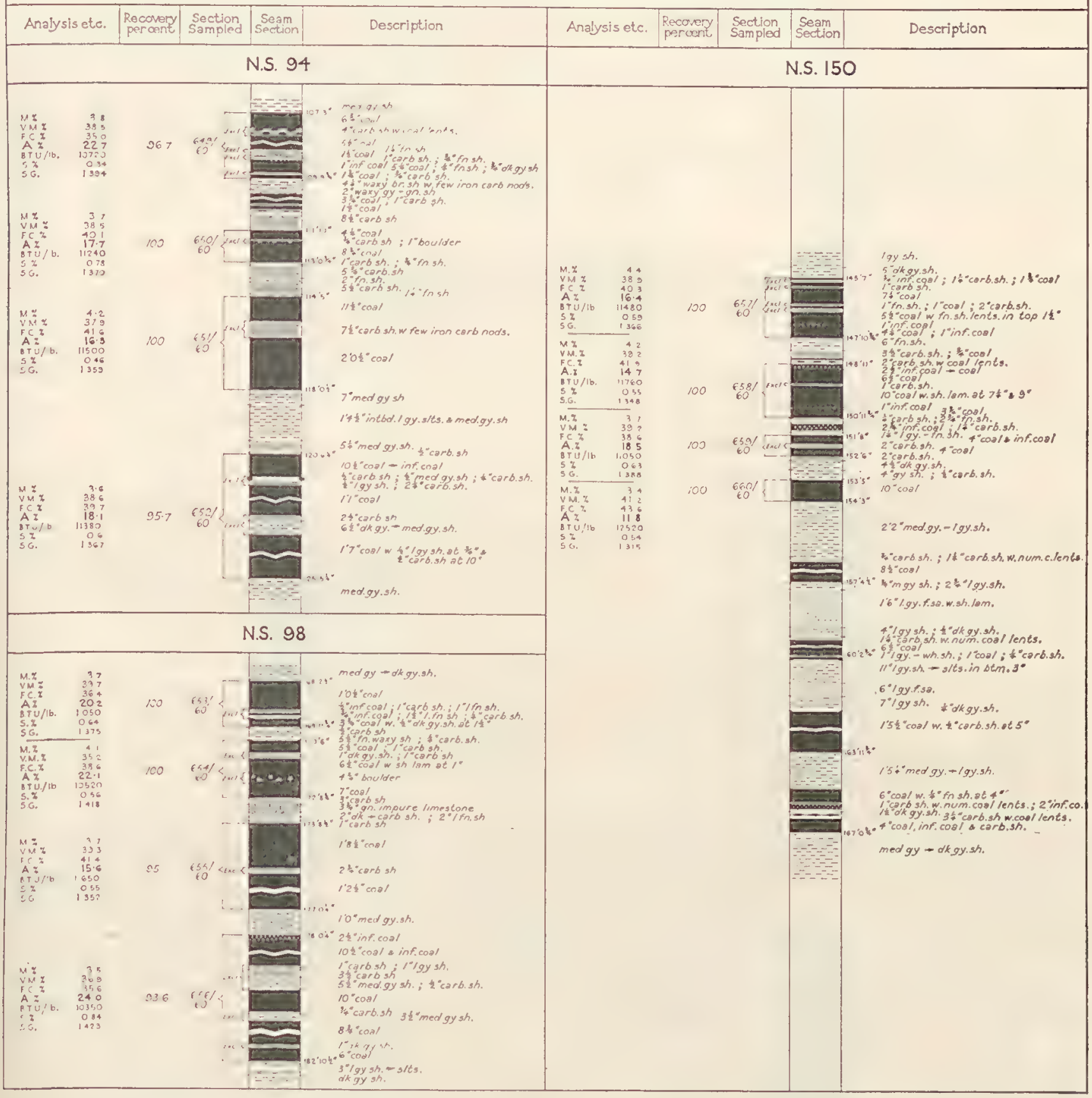
The **Roughrigg No. 5 working seam** lies from 30 ft. in the west to 100 ft. in the east below the United No. 7 Top seam. The intervening strata in the west are predominantly shales with some sandstone beds. Easterly, as the interval between the two seams increases, sandstone predominates. Several thin, persistent coal seams lie between the United No. 7 Top seam and the Roughrigg No. 5 working seam throughout the area.

The Roughrigg No. 5 working seam contains a characteristic waxy, fawn shale band near the roof. Because of this, and its stratigraphic position, it is correlated with the Lowfield seam (Cameron, 1960). In this area, it contains two persistent fawn shale bands some 6 in. apart, the lower occurring approximately 9 in. from the floor. South and west of the workings, the seam deteriorates slightly, as some carbonaceous shale occurs between and above the two fawn bands. Also, several coal plies lie directly below the seam. The section worked in United No. 7 Colliery includes three of these coal plies. The stone interbeds are known there as the "bluey", "brushing", and "double" bands respectively. These three bands, as well as the two fawn bands, have been recognised in the drill holes, and, except for the "bluey" band, show little variation. The "bluey" band in the eastern workings of United No. 7 Colliery consists of carbonaceous shale with a coal interbed. The upper carbonaceous band can be recognised in the bores, but the lower one is not present in N.S. 94, N.S. 98, and N.S. 235. In N.S. 150, both carbonaceous bands are represented by grey shale,

FIG. 5A

ROUGHRIGG No 5

DIAGRAMS OF ROUGHRIGG No 5 WORKING SEAM
DETAILS OF CORE RECOVERY AND ANALYSIS



the lower one being 2 ft. 2¾in. thick. The correlation between sections worked in Roughrigg No. 5 and United No. 7 Collieries is shown on fig. 6. Except for N.S. 245, boreholes drilled to the east show no evidence of coal deterioration in the Lowfield seam. However, the interval to the underlying coal bands has increased, while the thickness of coal in these bands has decreased.

Coal-bearing strata were penetrated for approximately 150 ft. below the Roughrigg No. 5 working seam in N.S. 94, but no coal seam in this part of the succession was found to be of economic importance. Drilling was continued to 381 ft. 8 in. The last coal was penetrated at 261 ft. 2½ in. From this depth to 328 ft. 4 in., the normal Walloon-type sediments of fine-grained sandstone, siltstone and shale

were penetrated. Below 328 ft. 4 in., thin beds of coarse pebbly sandstone occur interbedded with the sediments. This section, which, except for the thin beds of pebbly sandstone, is lithologically similar to Walloon-type sediments is correlated with the **Marburg Sandstone.**

STRUCTURAL GEOLOGY

The regional dip of the Walloon Coal Measures in the Roughrigg No. 5 mine area is approximately 2 degrees to the south-south-east.

One major fault has been encountered in the Roughrigg No. 5 workings. This is possibly the same fault system which stopped development to the south-west in Roughrigg Nos. 1 and 4 Collieries. A study of mine workings and of structure contours on the base of the Lowfield seam, indicates that this fault, trending north-west–south-east, is a normal fault dipping to the north-east, with a downthrow to the north-east of approximately 70 ft. along the eastern workings of Roughrigg No. 5 Colliery. The workings of Roughrigg No. 7 Colliery indicate that the fault, if it persists to the south, would lie to the north-east of borehole N.S. 9, in which case boreholes drilled previously in the Roughrigg No. 7 area are sited to the south-west of the fault.

FIG. 5B

ROUGHRIGG No 5

DIAGRAMS OF ROUGHRIGG No 5 WORKING SEAM
DETAILS OF CORE RECOVERY AND ANALYSIS

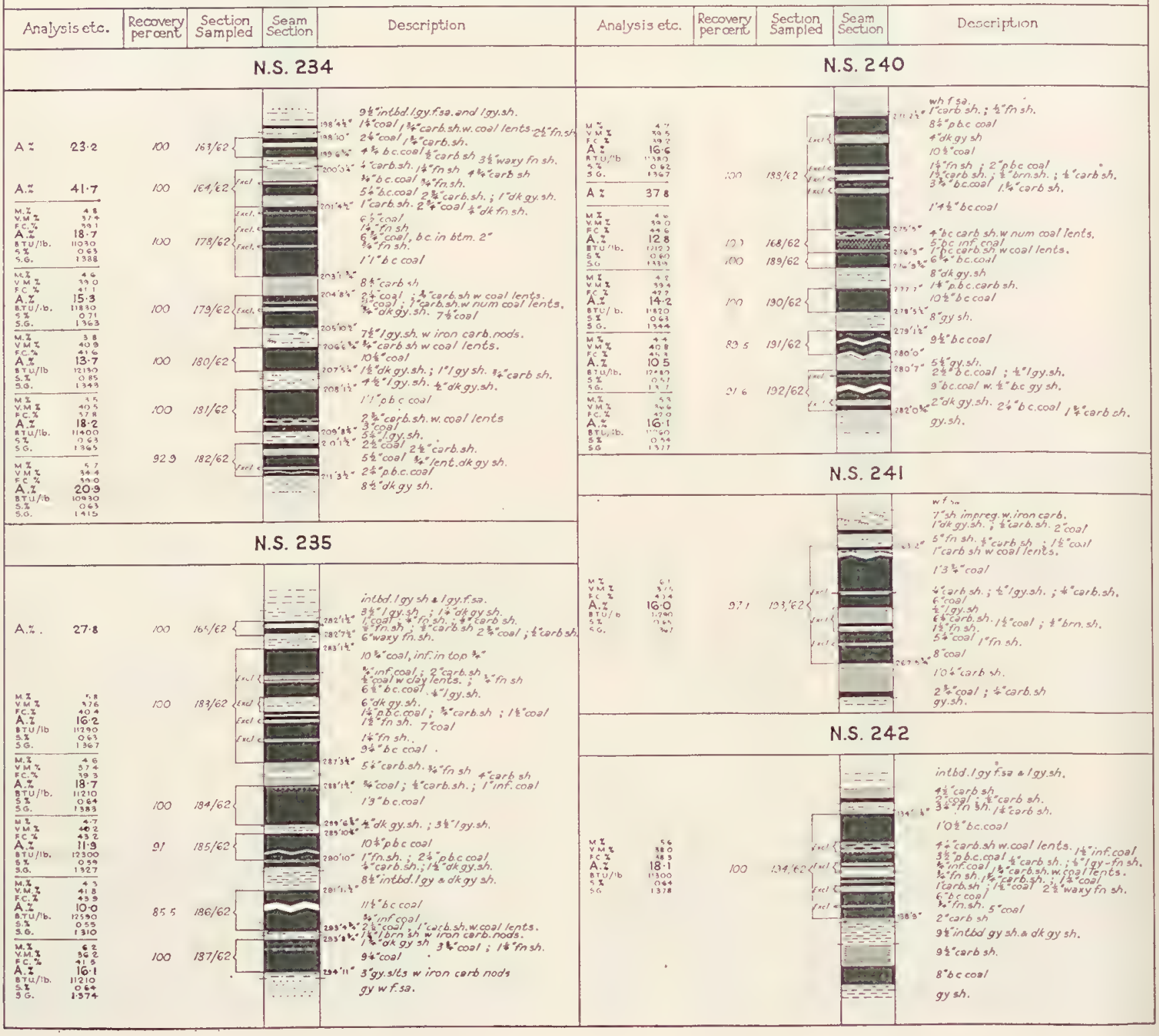
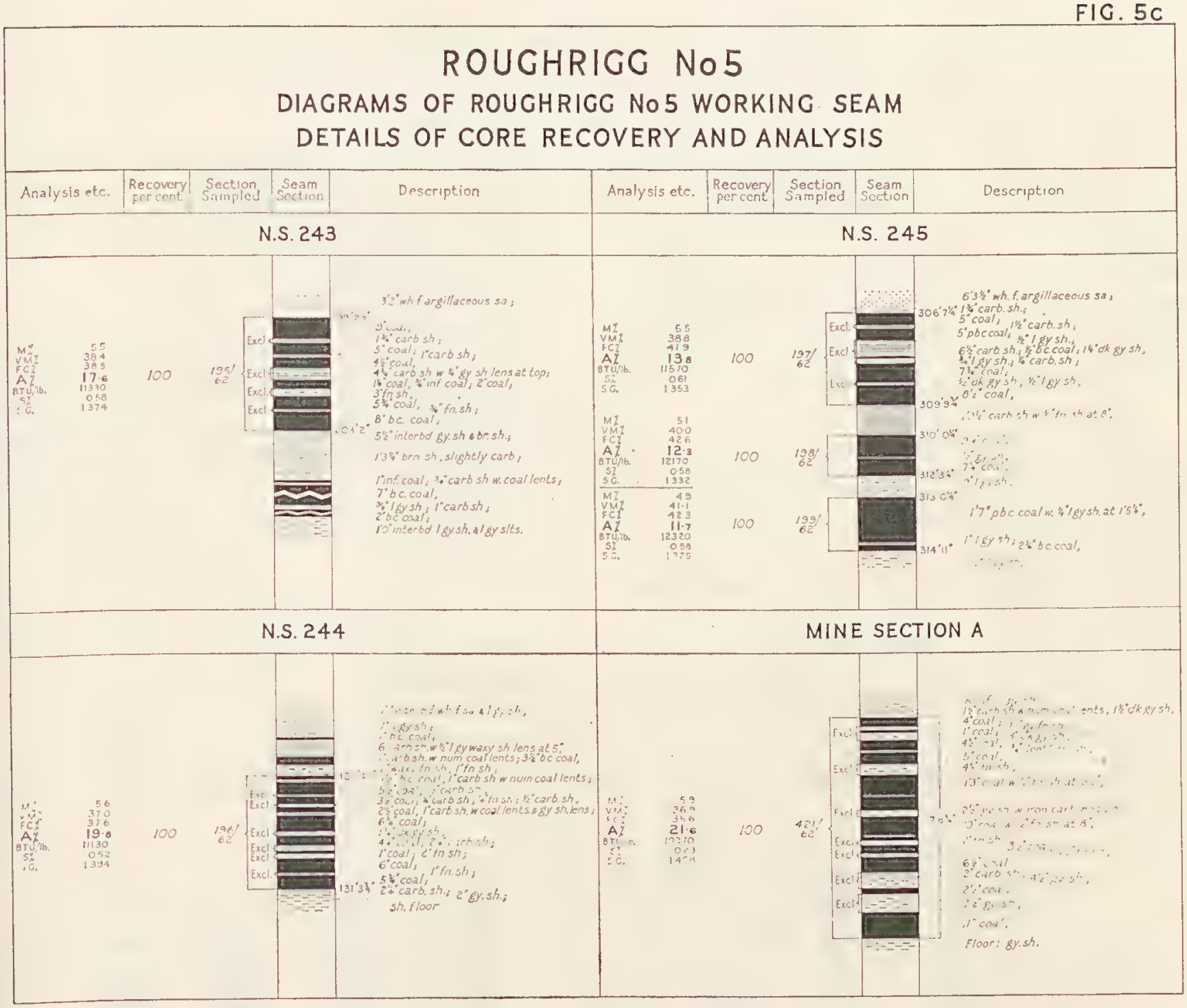


FIG. 5c



Faulting was encountered in both N.S. 232 and N.S. 233 in the south of the area. A study of reduced levels on the base of the Lowfield seam indicates a fault between these two holes. This is probably a continuation of the fault encountered in the United No. 7 area. It strikes east-south-east–west-north-west, and dips to the north. Downthrow is to the north, displacement being approximately 50 ft. between these two holes.

COAL RESOURCES

The criteria which have been used for assessing workability of coal sections cored by diamond drilling in the Rosewood Coalfield are:—

(i) a minimum thickness of 3 ft.

(ii) a workable coal to stone ratio.

(iii) a maximum ash content of 25 per cent. after the exclusion of stone bands normally removed in practice.

The status of reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings)—

(*a*) measured reserves—up to 12½ chains.

(*b*) indicated reserves—from 12½ to 20 chains.

The areas of both measured and indicated reserves are defined as extending no more than five chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

During the testing of the Roughrigg No. 7 area in 1952, workable sections were obtained in N.S. 2, N.S. 3, and N.S. 8 in the Roughrigg Lower seam, of which the top section in N.S. 3 only, and the bottom section in all three holes were analysed. The bottom section has been correlated with the United No. 7 Top seam, and the top section with the lower of the two persistent coal seams lying between the United No. 7 Top seam and the United No. 8 Top seam. Workable sections in the **United No. 7 Top**

seam were penetrated in N.S. 232 and N.S. 238 during the present programme. The section in N.S. 239 lies just outside the limits of workability, but due to the thinning of the interval to the overlying coal seam, a workable section was obtained in the full sequence. The sections analysed, with their results, are shown on fig. 4. Measured reserves in the United No. 7 Top seam, embracing boreholes N.S. 2, N.S. 3, N.S. 232, and N.S. 238, and amounting to 250,000 tons, have been established over 38 acres. Average thickness of coal is 4 ft. 0 in., contained in an average working thickness of 5 ft. 2½ in. Weighted average ash content is 18·2 per cent., and weighted average specific gravity is 1·37. Indicated reserves of 60,000 tons have been estimated over an area of 8 acres adjoining this area on the south-east, and embracing borehole, N.S. 8.

Measured reserves in the **Roughrigg No. 5 working seam** have been established in two areas. Workable sections were obtained in N.S. 241-244 lying east of mine workings. These reserves lie wholly within the Lowfield seam below the characteristic waxy, fawn shale. They extend over 48 acres, and total 240,000 tons. Average coal thickness of 3 ft. 1½ in. is contained in an average working thickness of 4 ft. 0 in. Weighted average ash content is 17·5 per cent., and weighted average specific gravity is 1·34. South and west of the workings, where the underlying coal and shale bands lie close to the Lowfield seam, workable sections were obtained in N.S. 94, N.S. 98, N.S. 150, N.S. 234, N.S. 235, and N.S. 240. Between the present workings and the first line of bores, the "bluey" band thins, allowing the coal between this and the "brushing" band to be worked together with the present working section. Also, west of the workings, the coal in the Lowfield seam deteriorates, but workable sections with the "brushing" band at the floor were obtained in N.S. 94 and N.S. 98. In estimating the reserves, allowance has been made for such changes in the working section and coal thicknesses. The area of measured reserves embracing the holes mentioned above totals 87 acres. These reserves are approximately 600,000 tons. Weighted average working

FIG. 6

ROUGHRIGG No 5 · CORRELATION DIAGRAM

ROUGHRIGG No 5 WORKING SEAM

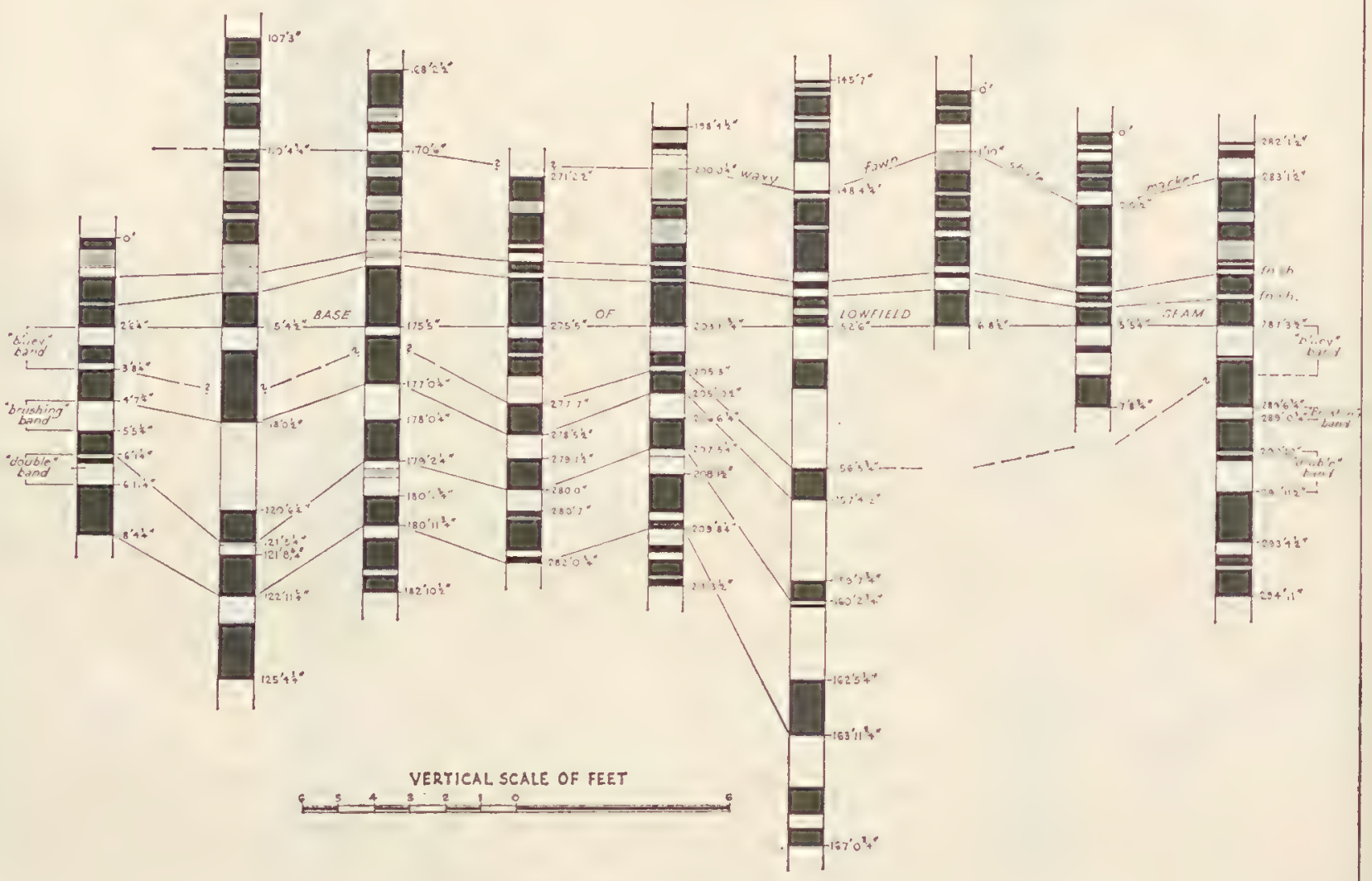
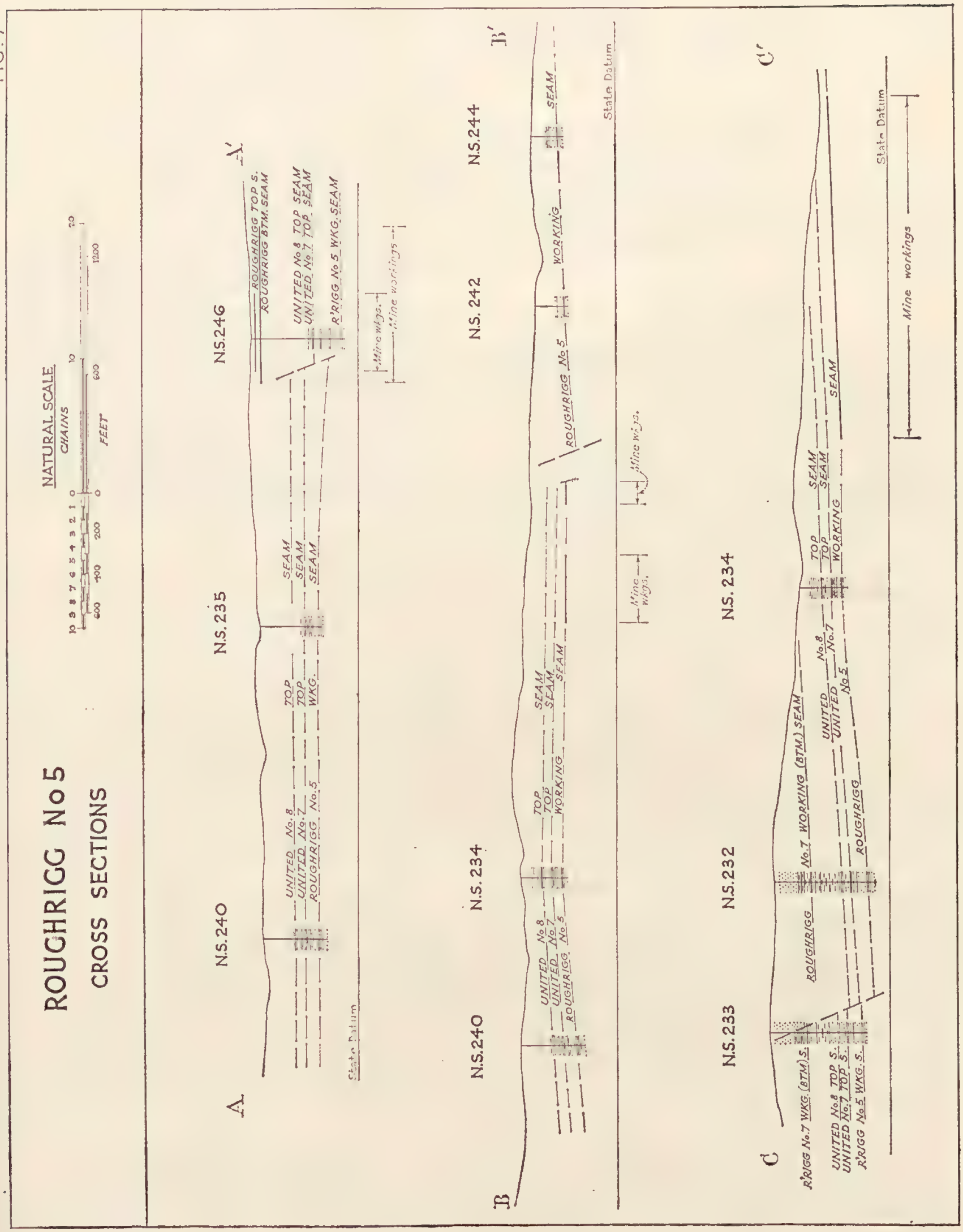


FIG. 7

ROUGHRIGG No 5

CROSS SECTIONS



thickness of 5 ft. 10 in. contains a weighted average coal thickness of 4 ft. 1½in. Weighted average ash content is 16·2 per cent., and weighted average specific gravity is 1·37. The sections analysed, together with results, are shown on fig. 5

NATURE OF COAL

The coal from the sections analysed from the Roughrigg No. 5 mine area is of high volatile bituminous rank (A.S.T.M. classification). Fixed carbon, calculated on a dry, mineral-matter-free basis, varies from 47.0 per cent. to 55.0 per cent. Calorific value, calculated on a moist, mineral-matter-free basis, ranges from 13,590 to 14,930 B.Th.U. per lb.

CONCLUSIONS

As a result of diamond drilling in the area by the Department of Mines in 1952, 1957, 1959, and 1961, reserves have been established in two seams.

In the **United No. 7 Top seam,** measured reserves amount to 250,000 tons, and indicated reserves to 60,000 tons.

Measured reserves of 240,000 tons have been estimated in the **Roughrigg No. 5 working seam** to the east of colliery workings; while to the south and west, an additional 600,000 tons have been estimated in the Roughrigg No. 5 working seam—United No. 7 Bottom seam sequence.

The fault which limited development of Roughrigg No. 5 Colliery to the east has a downthrow to the north-west of approximately 70 ft. in the vicinity of the colliery.

The continuation of the fault occurring in the United No. 7 area into the Roughrigg No. 5 mine area, where it has a displacement of approximately 50 ft., is indicated.

REFERENCES

CAMERON, J. B., (1960): Coal resources—Rosewood-Walloon coalfield (Roughrigg No. 5 mine area—progress report). Unpub. rep. Geol. Surv. Qld.

————, 1961: Coal resources—Rosewood-Walloon coalfield (Oakleigh mine area). *Qld Govt Min. J., 62,* 416-427.

————, 1963: Coal resources, Rosewood-Walloon coalfield (United No. 7 mine area). *Geol. Surv. Qld Publ., 310,* 9-15.

HAWTHORNE, W. L., 1954: Coal resources—Rosewood coalfield (Roughrigg mine area). *Qld Govt Min. J., 55,* 307-312.

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

11th October, 1962.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (WESTVALE No. 7 MINE AREA)

By E. S. Chiu Chong

SUMMARY

A small group of abandoned adits comprising Lowfield No. 2 and Westvale Nos. 6, 7, and 8 Collieries lies 10 to 15 chains from the base of a 200 ft. high escarpment forming the southern face of the Rosewood Bluff.

When Westvale No. 7 Colliery ceased production early in 1954, an inspection was made to investigate the possible northward extension of reserves. In the absence of reliable information regarding the northern faces in Lowfield No. 2 and Westvale No. 6 Collieries diamond drilling was recommended and an initial site was selected to the north of the workings.

Two holes drilled as part of this year's programme showed deterioration of the seam sections to the north-east and it became evident that no workable extension in any of the three seams previously mined could be expected in the area readily accessible to the drill.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

As part of the programme of diamond drilling to prove reserves in the Rosewood-Walloon Coalfield, attention was directed to an area at the southern edge of the Rosewood Bluff. Two diamond drillholes, N.S. 151 and N.S. 152 were completed during March and April, 1959, using the Department of Mines' Sullivan 22 H.D. plant. Total footage drilled was 613 ft., overall core recovery being 93·0 per cent.

The report is accompanied by the following plans and diagrams:—

(*a*) Locality Map—fig. 1.

(*b*) Plan showing positions of boreholes, extent of abandoned mine workings, surface contours at 20 ft. intervals and underground levels on State Datum—fig. 2.

(*c*) Generalised bore sections—fig. 3.

(*d*) Detailed sections of Westvale No. 7 seam—fig. 4.

(*e*) Fig. 5. consisting of—

(i) Detailed sections of Lowfield No. 2 Top seam

(ii) Detailed sections of Lowfield No. 2 Bottom seam

(*f*) Correlation diagram of Lowfield No. 2 Top and Bottom seams, showing equivalent sections in the collieries and in the boreholes—fig. 6.

MINE WORKINGS

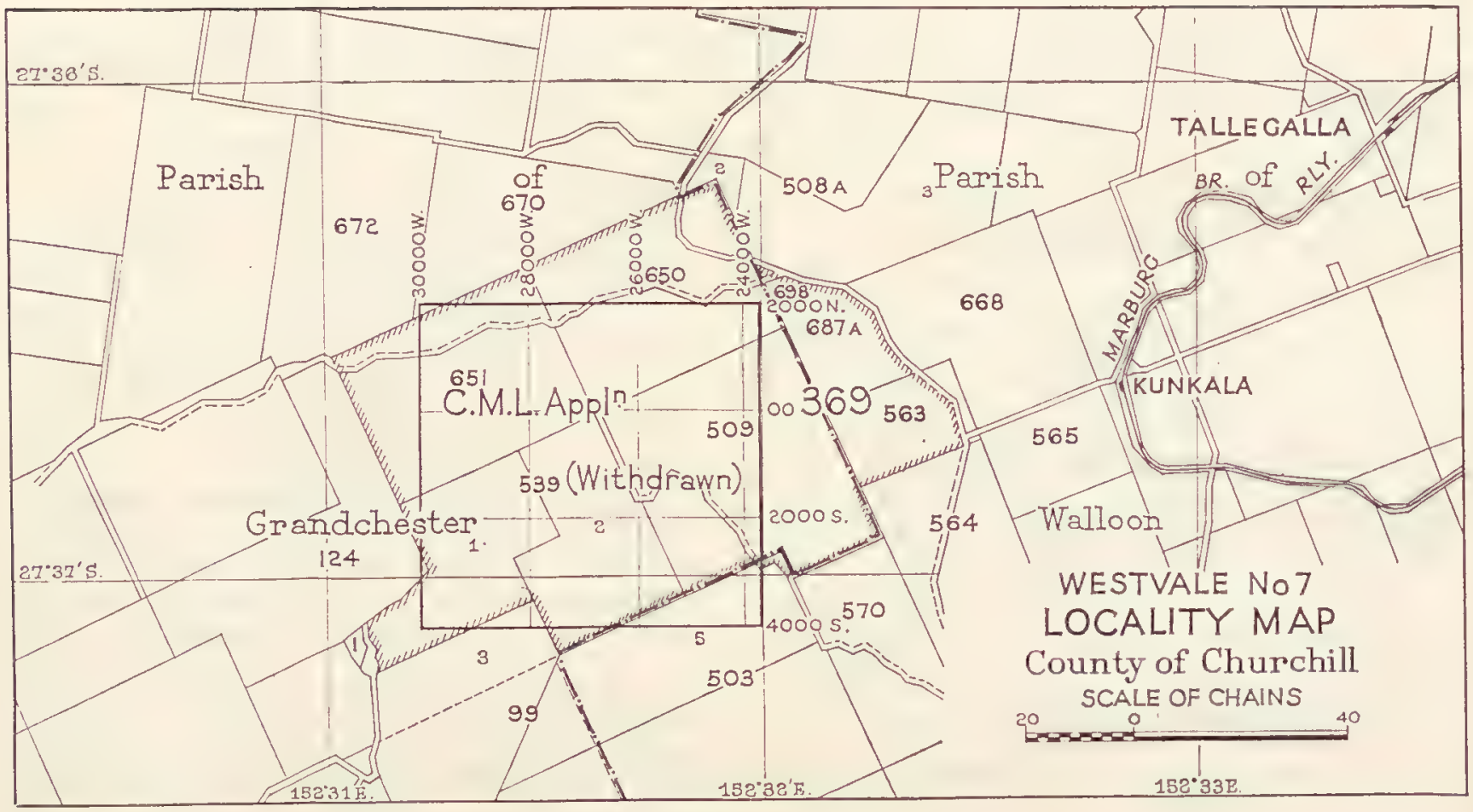
The area, which lies some four miles north-west of Rosewood Railway Station, was previously worked by Lowfield No. 2 and Westvale Nos. 6 and 7 Collieries. A new tunnel, Westvale No. 8, was begun but was abandoned because of insufficient cover to the seam.

This group of tunnels lies 10 to 15 chains from a 200 ft. escarpment on the southern side of Rosewood Bluff. As none of them is now accessible, much of the information concerning mine workings was obtained from unpublished reports by Hawthorne (1952) and Cameron (1954). During operation of the collieries, the area was held as Coal Mining Lease No. 369, in the name of S. M. Dixon and W. L. Haenke, trading as Westvale Collieries. This application, filed in March 1951, was withdrawn in June, 1957. Westvale No. 7 Colliery, the last pit operated in this area, was abandoned in January, 1954.

Three seams have been exploited in the area. Westvale No. 7 Colliery worked the uppermost, while both Westvale No. 6 and Lowfield No. 2 Collieries worked the two underlying seams. The Lowfield No. 2 Top seam, known locally as the "clay" seam because of the presence of a persistent plastic clay band near the roof, lies approximately 40 ft. beneath the Westvale No. 7 seam. The interval between the "clay" seam and the lowest seam exploited in the area varies from a few inches in Westvale No. 6 Colliery to over 3 ft. in Lowfield No. 2 Colliery. These two collieries closed down in August 1953. A trial shaft, G, (fig. 2) put down ahead of Westvale No. 8 tunnel, penetrated the Lowfield No. 2 Top seam 72 ft. from the surface. In this shaft, the interval between the Lowfield No. 2 Top and Bottom seams is 4 ft. 6 in.

Sections of the three seams measured in the workings by W. L. Hawthorne in 1952 and J. B. Cameron in 1954 are shown in figures 4 and 5, together with sections F and G, supplied by the colliery management.

FIG. 1



GENERAL GEOLOGY

Rosewood Bluff is one of the few relatively high areas seen on the Rosewood-Walloon Coalfield. It stands some 800 ft. above the flat lying country to the south. This flat country, covered by a veneer of Quaternary alluvium, is traversed by several meandrine streams.

The Bluff is capped by Tertiary sediments and basalt flows, the latter forming a protective cover over the Jurassic Walloon Coal measures lying unconformably beneath. These measures consist mainly of shales and fine-grained sandstones, with several coal seams. Because of the high percentage of clayey material, outcrops of the measures are rare. They are conformably underlain by barren sandstones and shales. These strata, which Reid (1927) named "The Lower Sandstone Series", may be correlated with the Marburg Sandstone of the type area to the north of the coalfield.

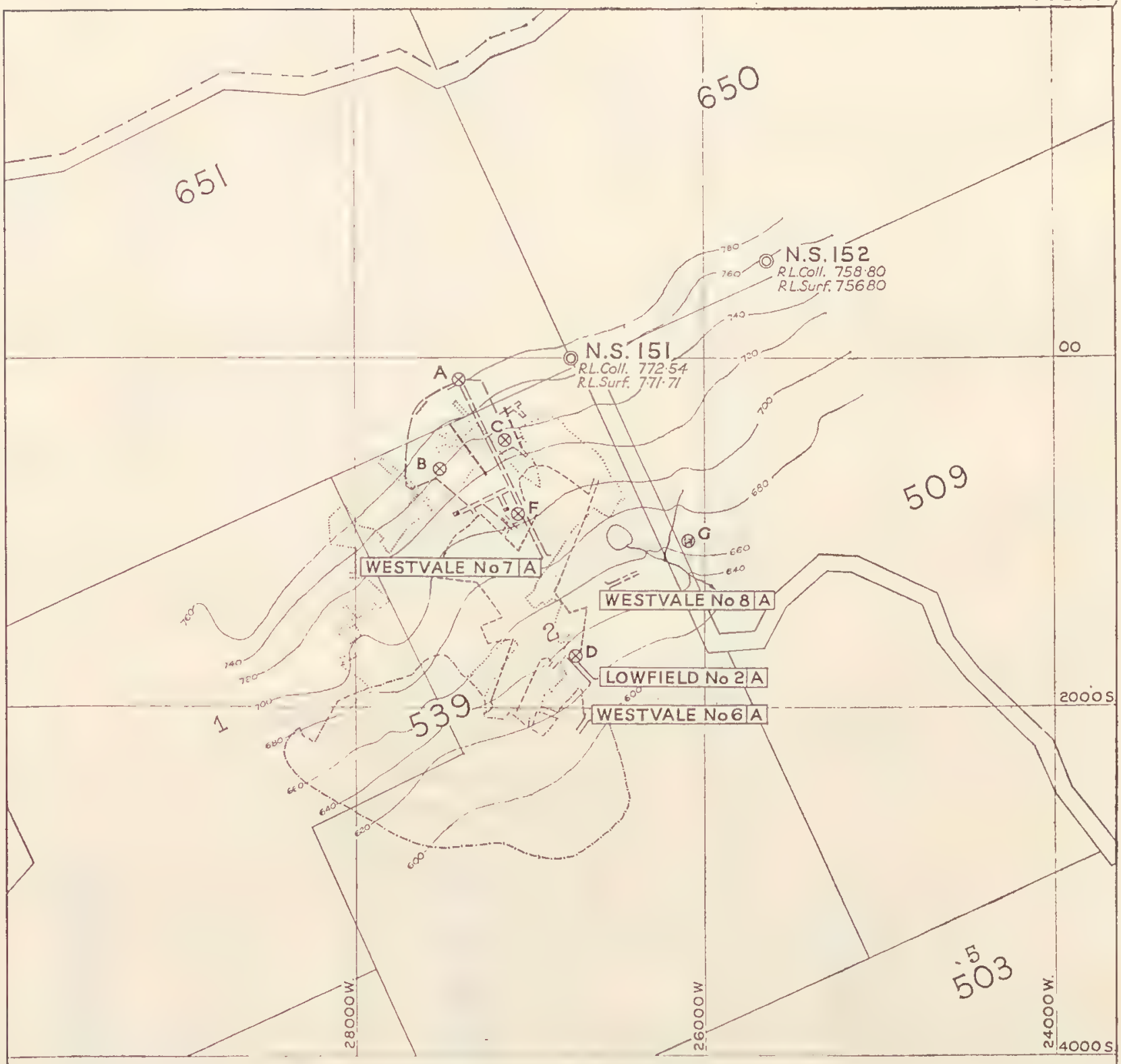
SUBSURFACE GEOLOGY

Only two boreholes, N.S. 151 and N.S. 152, were drilled in the area.

The **Westvale No. 7 seam** was encountered at 120 ft. 8½ in. in N.S. 151, the strata between it and the Tertiary basalt above being fine-grained arenites with one coaly horizon. The seam as seen in Westvale No. 7 Colliery is 5-6 ft. thick, and contains four coaly sections separated by thin bands of grey and fawn shales. Only the bottom three sections of coal were worked, the thickness of this working section being about 4 ft. 7 in. In N.S. 151, a section equivalent to the working section can be distinguished, but the unworked top coal ply is presumed to have been contemporaneously eroded by the sandstone lying directly above the seam. Both the two stone bands in the working section have a relatively constant thickness. The higher one, consisting of grey shales with a few inches of coal, has a thickness of approximately 1 ft. 3 in. The lower stone band, a waxy dark fawn shale, 3-4 in. thick, occurs about 1 ft. 4 in. from the floor of the seam. The Westvale No. 7 seam was not cored in N.S. 152. Detailed sections of this seam are shown in figure 4.

The **Lowfield No. 2 Top seam** locally known as the "clay" seam, was encountered in N.S. 151 at 163 ft. 2¾ in., being 38 ft. 4½ in. below the Westvale No. 7 seam. It was met at 159 ft. 7½ in. in N.S. 152. The strata between the two seams are mainly shales and siltstones with two persistent coaly horizons. The "clay" seam may be correlated, on stratigraphic and lithologic grounds, with the **Lowfield seam,** previously described by Cameron (1956). It was so called in this area because of a characteristic waxy fawn shale, 3-8 in. thick, occurring near the roof. A grey shale band, containing a few inches of coal near the top, splits the seam. This band increases towards the northeast, being 1 ft. 3 in. in section D, growing to 2 ft. 2 in. in N.S. 152 (fig. 5). The working thickness of this seam in Lowfield No. 2 and Westvale No. 6 Collieries

FIG. 2



DEPARTMENT OF MINES, QUEENSLAND

WESTVALE No 7 MINE AREA
ROSEWOOD – WALLOON COALFIELD

Showing boreholes, mine workings and topography

To accompany report by E.S. Chiu Chong, B.Sc., Geologist.

Topographic survey by E. Cowley, Assistant Surveyor

SCALE OF CHAINS

10 0 10 20

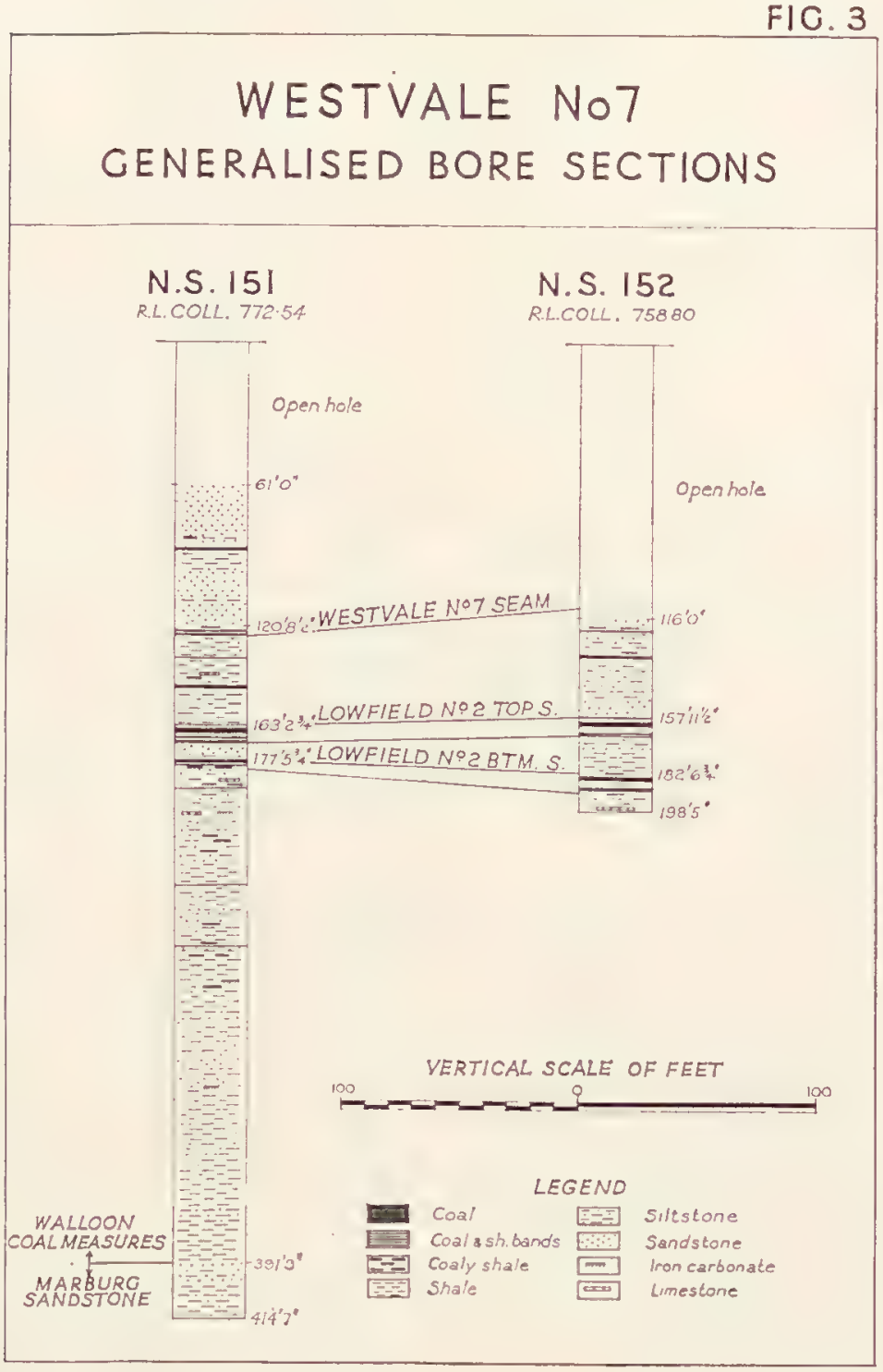
Twenty chain grid on True North. Point of origin Perry's Nob Trig. Station. Elevations in feet on State Datum

LEGEND

Colliery (abandoned) .... NEATH A
Seam Section measured ..... A
Surface contours .....
Limit of Mine Workings on Westvale No 7 Seam .....
Lowfield No 2 Top Seam .....
Lowfield No 2 Bottom Seam .....
Lowfield No 2 Top & Bottom Seams, worked together .....

Borehole ..... N.S. 19
Shaft .....
Fault in Mine Workings .....

FIG. 3



was about 6 ft. Although on visual examination, the seam is workable in N.S. 151, coal deterioration and thickening of the stone split in N.S. 152 precludes the development of a working area. For this reason, the section was not analysed.

As mine workings were extended to the south-west, another seam was found just below the "clay" seam. Subsequently, these two seams were worked in both Lowfield No. 2 and Westvale No. 6 Collieries. The minimum distance between these two seams is a few inches in Westvale No. 6 Colliery and about 3 ft. in Lowfield No. 2 Colliery. The **Lowfield No. 2 Bottom seam** was met at intervals of 6 ft. 3½ in. in N.S. 151 and 17 ft. 1 in. in N.S. 152 below the "clay" seam, the intervening strata being white fine sandstones and light grey shales. Having a thickness of 3-4 ft. in the mine workings and in N.S. 151, it is composed of four sections of coal separated by grey shales of varying thickness. In N.S. 152 the seam has increased to over 7 ft. due to the thickening of these stone bands. A correlation diagram of the two seams worked in Lowfield No. 2 and Westvale No. 6 Collieries is shown in figure 6. Correlation of the Lowfield No. 2 Bottom seam with the coal **seam** just **below the Lowfield seam,** described by Cameron (1962), is based on stratigraphic and lithological grounds.

In borehole N.S. 151, coaly horizons were penetrated for about 100 ft. below the Lowfield No. 2 Bottom seam. None of these is of economic importance in the area. The last coal seam was penetrated at a depth of 262 ft. below the surface. To date, the greatest known thickness of the productive part of the Walloon Coal Measures is 570 ft. in the Normanton No. 1 mine area (Cameron, 1959). Only the lower

200 ft. of these productive measures is represented in this area, the upper part having been removed by denudation prior to overflow of Tertiary basalt.

Underlying the lowest coaly horizon at 262 ft. 0 in., typical Walloon sediments, but without coal seams, were penetrated in N.S. 151 to 391 ft. 9 in. Below this depth, coarse pebbly sandstones occur interbedded with sediments similar to those above. The base of the Walloon Coal Measures is taken as the top of the topmost bed of pebbly sandstone which occurs at 391 ft. 9 in. The beds lying conformably beneath are correlated with the **Marburg Sandstone.**

STRUCTURAL GEOLOGY

Regional dip of the Walloon Coal Measures in the Westvale No. 7 mine area is approximately 2 degrees to the south-east.

Faulting encountered in this area is of only minor importance. Cameron (1954) reported three reverse faults in the Westvale No. 7 workings, each with an upthrow to the west of only a few feet. Two strike approximately north-east–south-west, while the third trends north-south. None of these faults seriously hindered mine development. Faulting has not been reported in the other collieries, nor was it encountered in the two boreholes.

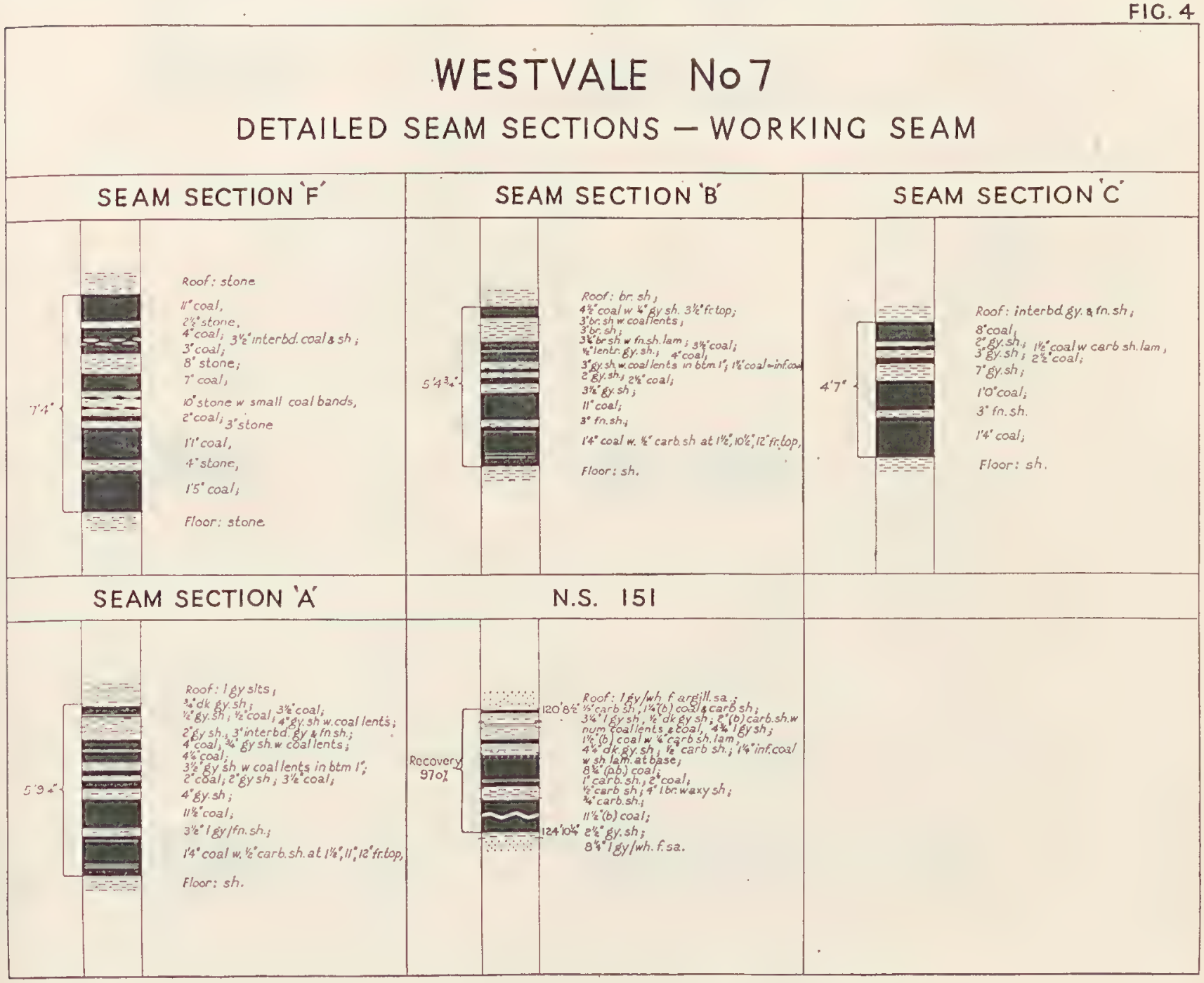
COAL RESOURCES

No reserves have been established in this mine area. From the two holes drilled, only one section, that of the **Lowfield seam** in N.S. 151, had a required minimum thickness and a workable coal to stone ratio. Because of the poor quality of the seams penetrated, drilling in the area was discontinued.

CONCLUSIONS

Three seams have previously been exploited in this area. Westvale No. 7 Colliery worked the uppermost seam. Approximately 40 ft. below lies the

FIG. 4


WESTVALE No 7
DETAILED SEAM SECTIONS — WORKING SEAM
SEAM SECTION 'F'
7'4"
Roof: stone
11" coal,
2½" stone,
4" coal; 3½" interbd. coal & sh;
3" coal;
8" stone;
7" coal,
10" stone w small coal bands,
2" coal; 3" stone
1'1" coal,
4" stone,
1'5" coal;
Floor: stone
SEAM SECTION 'B'
5'4¾"
Roof: br. sh;
4½" coal w ¼" gy sh. 3½" fr top;
3" br. sh w coal lents;
3' br. sh;
3¼" br sh w fn.sh. lam; 3½" coal;
½" lentr. gy. sh.; 4" coal;
3" gy. sh w. coal lents in btm 1"; 1½" coal + inf. coal
2" gy. sh.; 2½" coal;
3½" gy. sh;
11" coal;
3" fn. sh.;
1'4" coal w. ½" carb. sh at 1½", 10½", 12" fr. top,
Floor: sh.
SEAM SECTION 'C'
4'7"
Roof: interbd. gy. & fn. sh;
8" coal,
2" gy. sh.; 1½" coal w carb sh. lam,
3" gy. sh; 2½" coal;
7" gy. sh;
1'0" coal;
3" fn. sh.
1'4" coal;
Floor: sh.
SEAM SECTION 'A'
5'9"
Roof: 1 gy slts;
¾" dk gy. sh;
¼" gy. sh; ½" coal; 3½" coal;
2" gy sh.; 3" interbd. gy & fn sh.;
4" coal; ¾" gy sh. w coal lents;
4¼" coal;
3½" gy sh. w coal lents in btm 1";
2" coal; 2" gy sh; 3½" coal;
4" gy. sh;
11⅛" coal;
3½" 1 gy/fn. sh.;
1'4" coal w. ½" carb. sh. at 1⅛", 11", 12" fr. top,
Floor: sh.
N.S. 151
Recovery 97%
120'8½"
124'10¼"
Roof: 1 gy/wh. f. argill. sa.;
½" carb sh; 1¼" (b) coal & carb sh;
3¼" 1 gy sh; ½" dk gy sh; 2" (b) carb. sh. w
num coal lents & coal; 4¾ 1 gy sh;
1½" (b) coal w ¼" carb sh. lam;
4'4" dk. gy. sh; ½" carb sh.; 1¼" inf. coal
w sh lam. at base;
8¾" (pb.) coal;
1" carb. sh.; 2" coal;
½" carb sh; 4" 1 br. waxy sh;
¾" carb. sh.;
11½" (b) coal;
2½" gy. sh;
8¾" 1 gy/wh. f. sa.

WESTVALE No 7

DETAILED SEAM SECTIONS

LOWFIELD No 2 TOP SEAM

SEAM SECTION 'D'

Seam Section	Description
3'0½"	roof: wh f. sa; 2' f. coal, 1' inf. coal, 1' dk gy sh; 3' coal, 1' dk gy sh; 1' coal, 2" carb sh, 4" coal & 4" dk gy sh; 2½' carb. sh; 2" coal; 4' dk gy sh, 6" carb sh; 1'8" coal w ¾" carb bnd in flr top; 2'0" l gy sltst.

SEAM SECTION 'G'

Seam Section	Description
7'8"	5" dirty coal; 1' coal; 1'6" dk gy sh; 2'0" coal; 4" stone; 2" coal; 1'8" stone; 1'11" coal w penny bands; 46" sandy sh.

N.S. 151

Recovery	Seam Section	Description
100%	162'10¾"	2'2" med gy sh; ½" dk gy sh; 4" (pb) carb sh w num coal lents; 2¾" inf. coal; 1¾" carb sh. w num. coal lents; 6½" (b) coal; 3½" (b) carb sh w l gy/m sh lents & lams; 4" (b) carb sh w coal & gy lents, 3¼" f. sh; ¼" carb sh, 2" (b) coal, 2" carb sh w num coal lents & lams, 1" inf. coal, ¼" carb sh; 6¾" coal w num carb lam at 4¾"; 2" carb sh, ½" coal; ¾" carb sh; 5¼" coal; ¼" dk gy — med gy sh; 3" (b) carb sh w num coal lents; 1'0" (b) coal, 2" dk gy sh, 4¾" l gy/m sh (sick); 1" med gy sh — dk gy at top; 1'5" (b) coal, 2" dk gy sh w num coal lents; ¼" carb sh, 3¼" coal — inf. coal at base; 1" carb sh, ½" dk gy sh, 1" carb sh — coal; 3½" coal, ½" carb sh, 1¼" dk gy sh; 2" (pb) inf. coal; 5" (b) coal; ¼" carb sh.; 3" brn/carb sh; 3" (b) coal & carb sh w coal lents;
	171'2¼"	4" carb sh w coal lents; 4'9" l gy/wh. f. sa.

N.S. 152

Recovery	Seam Section	Description
98.2%	57'0½"	f. sh & argill. sa. — sh. arenite in pl; 1'0" (b) coal, 1'0" carb sh w num c lents, 1'0" carb sh, 4" dk gy sh, 1" l gy/m sh; 2" (pb) carb sh; 1'0" m gy sh, ½" carb sh; 1½" dk gy sh; 1'0" f. sh, 1' carb sh, 1" coal, ½" carb sh; ½" coal; ½" carb sh, 1¼" inf. coal; 1" carb sh w cal lacing, 1½" inf. coal, ¾" carb sh w cal lacings, ¾" carb sh w coal lents, 6" coal w carb sh lam at ¾", 1'0" carb sh, 6" coal — inf. coal; 10½" med gy sh; 1'0" m gy sh, ¼" carb sh, ½" (pb) coal; ¾" dk gy sh, 7" l gy sh, 5" dk gy sh, 1" coal, 1'0" dk gy sh, ¾" coal, 1'0" dk gy sh, ½" l gy sh, 1'0" carb sh, 3" coal, ¾" carb sh., ½" l brn f. sh; ½" carb sh, 10" coal — inf. coal in places, ½" carb sh; 1¾" med gy sh (slick); 7½" (pb) carb sh. w coal lents;
	167'5¾"	3¾" coal; ¾" carb sh; 4¼" med gy sh; 3¾" l gy f. sa.

LOWFIELD No 2 BOTTOM SEAM

SEAM SECTION 'D'

Seam Section	Description
3'0½"	2'0" l gy sltst; 4" l gy. f. sa; 2" coal, 1" carb sh (lent"); 1" coal, 1" carb. sh (lent"); 9" coal; 1' l gy. sh.; 2½" coal; 1½" m gy sh. (very variable in thickness); 1'3½" coal; 2½" m gy sltst; l gy sltst. & f. sa.

SEAM SECTION 'G'

Seam Section	Description
3'6½"	4'6" sandy sh; 9" coal; 2" stone; 9½" coal, 1" stone; 2" coal; 3" stone; 1'4" coal.

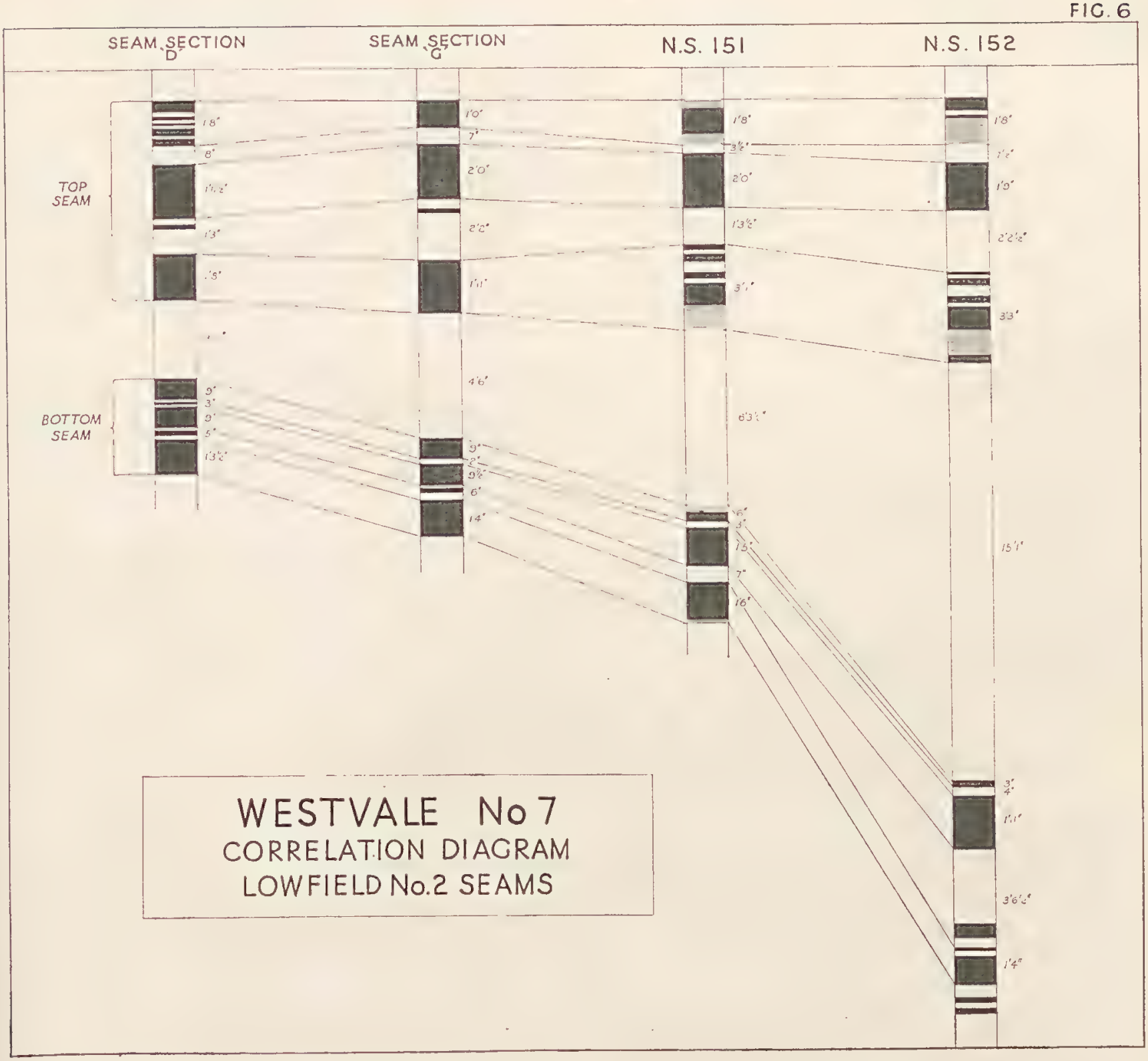
N.S. 151

Recovery	Seam Section	Description
75.0%	177'5¾"	1'6½" med gy sh; 3" carb sh. w coal lents; 2¾" coal, 2" carb sh. w num. coal lents; 3½" coal, ½" carb sh w coal lents; 2" (pb) coal; ¾" carb sh; 3¼" l gy/wh sh; 3¼" m gy sh (slick) 1'3¾" (b) coal, ¼" l gy/fn sh; 2¾" coal; 2¼" carb sh. w coal lents { 2½" (b) coal; ¾" (b) carb sh, 4" l gy. f sa 10½" l gy sltst. — sh. in btm. 4".
	181'8¾"	

N.S. 152

Recovery	Seam Section	Description
95.4%	89'1"	8" (¾" med gy sh — l gy sh; 3" coal; 3½" l gy sh w ½" carb sh at ½"; ½" coal, 2¾" coa. y sh. w num. CaCO₃ veins in b. ½" 15¾" (b) coal, 2'1½" l gy sltst — sh; 1'0" gy sh, 1½" dk gy sh, ½" gy wh sh, 5¼" (b) coal, 4¾" m gy sh ¾" (b) coal, ½" inf. coal, 2¼" m gy sh; 11½" (pb) coal w ¾" l f. sh. at 2" & 1" carb sh. at 7"; ¾" carb sh; 4¼" dk gy sh; ¾" carb. sh., 2½" (b) coal, 2" med gy sh; 3" (b) coal, 1" carb. sh; med. gy. sh;

FIG. 6



WESTVALE No 7
CORRELATION DIAGRAM
LOWFIELD No.2 SEAMS

Lowfield No. 2 Top seam, locally known as the "clay" seam. This is correlated with the Lowfield seam. The Lowfield No. 2 Bottom seam lies from a few inches in Westvale No. 6 Colliery to over 17 ft. in N.S. 152 below the "clay" seam. It is correlated with the coal seam found just below the Lowfield seam in the United No. 8 mine area. Both latter seams were worked by Westvale No. 6 and Lowfield No. 2 Collieries.

Because of the poor quality of the seams penetrated in the two holes drilled, no reserves were established in the area.

REFERENCES

CAMERON, J. B., (1954): Westvale No. 7 colliery, Rosewood. Unpub. rep. Geol. Surv. Qld.

———, 1956: Coal resources—Rosewood-Walloon coalfield (Lanefield No. 5 mine area). *Qld Govt Min. J., 57,* 457-459.

———, 1959: Coal resources—Rosewood-Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

———, 1962: Coal resources—Rosewood-Walloon coalfield (United No. 8 mine area). *Qld Govt Min. J., 63,* 125-137.

HAWTHORNE, W. L., (1952): Westvale Nos. 6 and 7 and Lowfield No. 2 collieries, Rosewood. Unpub. rep Geol. Surv. Qld.

REID, J. H., 1927: Coal mining and boring operations, etc., Rosewood. *Qld Govt Min. J., 28,* 4-8.

27th November, 1959.

S. G. REID, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 311

COAL RESOURCES, ROSEWOOD-WALLOON COALFIELD

Mount Elliott Mine Area
Mount Elliott Mine Area—Extension
Moorefield No. 3 Mine Area
Amberfield Mine Area

By J. B. CAMERON, B.Sc.App. (Geol.), Geologist

BRISBANE
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1963

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COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (MOUNT ELLIOTT MINE AREA)

By J. B. CAMERON

SUMMARY

Diamond drilling in 1956 was designed primarily to locate and test the working seam beyond a line of faulting met in development but also tested another seam some 90 ft. below it. Three holes totalled 641 ft. 10 in.

Of these, two holes drilled to the south of the workings showed overall upthrow of the seam to be less than 20 ft. and established measured reserves amounting to 185,000 tons in an area of 27 acres in the Top (Working) seam and 97,000 tons in an area of 19 acres in the Bottom seam.

The third hole was drilled to test the Bottom seam ahead of a projected development in the northern part of the mine. As a result, measured reserves were increased by 125,000 tons.

Between the two areas tested, a further 90,000 tons is indicated.

Reserves established thus total 497,000 tons.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

In 1956 emergency diamond drilling was carried out by the Mines Department in the Amberley district of the Rosewood Coalfield. From June to August three holes—N.S. 60, N.S. 63, and N.S. 68—were drilled by the Longyear No. 2 plant in the Mount Elliott mine area; aggregate footage was 641 ft. 10 in.

While the Mount Elliott drilling was designed primarily to locate and prove the working seam south of a line of faulting which was then hindering development, the opportunity was taken of testing another seam some 90 ft. below. This lower seam was first encountered during deepening of the original airshaft of Mount Elliott No. 1 Extended Colliery.

The procedure followed in the sampling and analysis of workable coal sections was similar to that previously described (Cameron, 1959). In this mine area, assessment of the drilling results was greatly facilitated by the excellent core recovery within the target horizons of over 99 per cent. Overall core recovery was 96·4 per cent.

Accompanying the report are the following plans, sections and diagrams:—

(*a*) Locality Plan—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and boundaries of measured and indicated reserves; together with one cross-section—fig. 2.

(*c*) Generalised bore sections—fig. 3.

(*d*) Diagrams showing detailed sections of the Working and Bottom seams with analytical results—fig. 4.

MINE WORKINGS

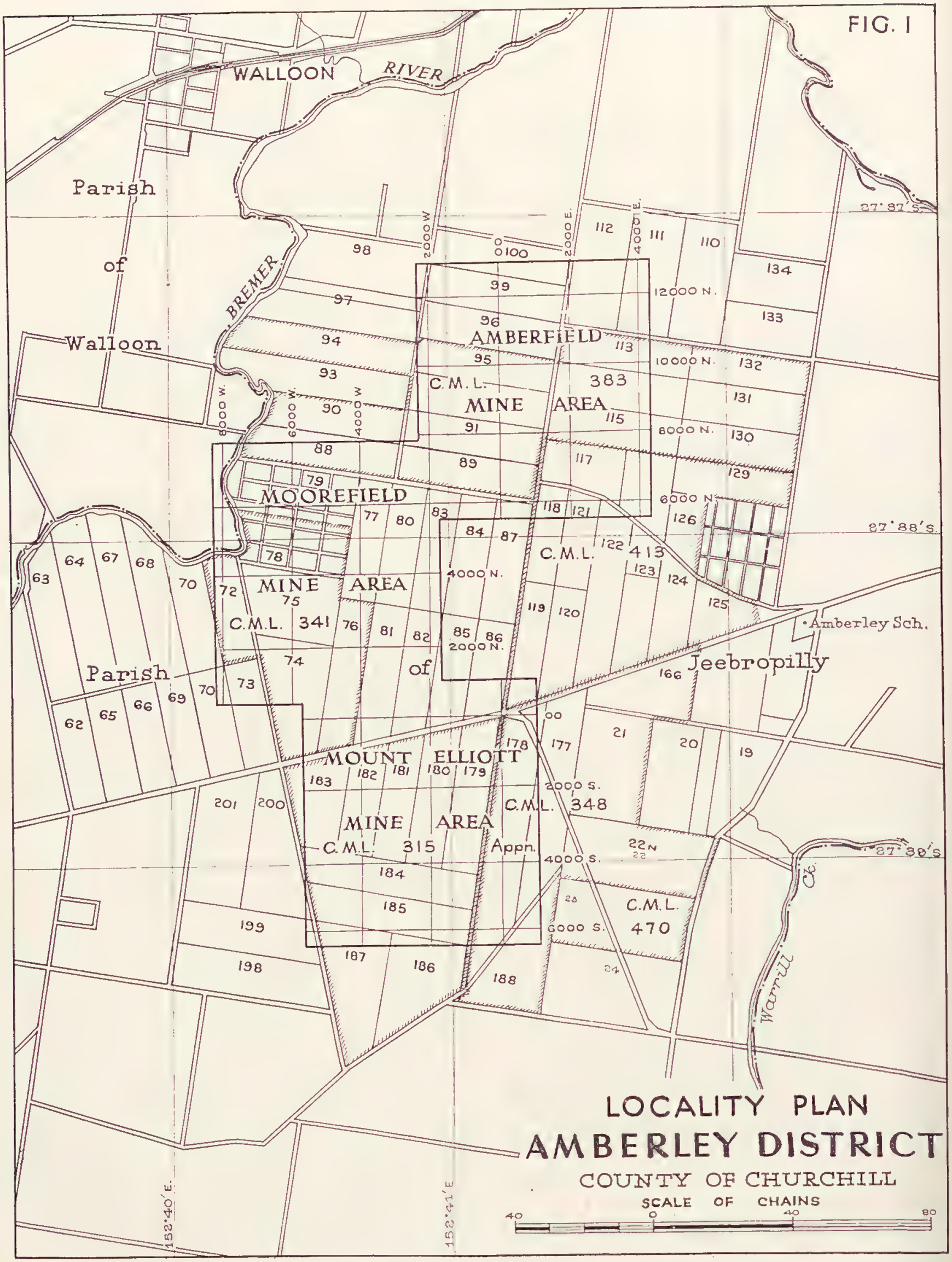
Mount Elliott No. 1 Extended Colliery is situated in the Amberley district, 2¾ miles south-south-east of Walloon Railway Station and approximately 5 miles east of Rosewood. Within 20 chains are the abandoned Mount Elliott Nos. 1 and 2 Collieries. These three pits all worked the same seam. The workings lie within Coal Mining Lease (Application) No. 315 and C.M.L. No. 348 held, along with C.M.L. No. 470, by Philip Bernard Fallu and party trading as Mount Elliott Coal Company.

The first coal produced in the Amberley district was won from Mount Elliott No. 1 Colliery in 1929. Production commenced at Mount Elliott No. 2 Colliery in 1945, although the access adit was driven as early as 1935 when it was known as Bailey's tunnel. Since 1948 all coal has come from Mount Elliott No. 1 Extended Colliery where a second seam, some 90 ft. below, is also being developed.

GENERAL GEOLOGY

The coal-bearing strata of the Mount Elliott mine area belong to the Walloon Coal Measures of Jurassic age and, although separated from the rocks of the type area by the wide alluvial valley of the Bremer River, are known, as a result of surface mapping, to occur near the top of that formation. The top seam worked so extensively in the Mount Elliott mine area forms part of a coaly sequence some 60 ft. thick. The upper group of seams can be correlated with a similar productive sequence which occupies the same stratigraphic position in the Perry's Knob area of the coalfield. The group there was first termed the Rosewood seams by Reid (1922) and recently was described more fully by Cameron (1959).

FIG. 1



LOCALITY PLAN
AMBERLEY DISTRICT
COUNTY OF CHURCHILL

SCALE OF CHAINS
40 0 40 80

DEPARTMENT OF MINES, QUEENSLAND

MOUNT ELLIOTT MINE AREA
WALLOON–ROSEWOOD COALFIELD

Showing topography, boreholes, mine workings, and areas within which reserves have been estimated

To accompany report by J.B Cameron, B.Sc.App(Geol)

Topographic survey by Ewan Cowley, Assistant Surveyor

FIG. 2

SCALE OF CHAINS

4 0 4 8 12 16 20

SURVEY DATA

Grid of 20 chain co-ordinates. Meridian of Grid is True North at point of origin, peg A, bearing 350° and distant 16' from north-east corner of Por 179, Parish of Jeebropilly. Elevations in feet on State Datum

EXPLANATION

Diamond drillhole ◎ N.S. 71 — *Adit* — *Shaft*

Colliery NEATH — *Surface contour* — *Section line* A—A'

Underground level 699 — *Seam section measured* ⊗

Mine workings: — Top Seam — *Bottom Seam*

Measured reserves, Top Seam

Measured reserves, Bottom Seam

Indicated reserves, Bottom Seam

Fault in Mine workings

85 86 119 179 180 178 183 182 181 184 185 187

Old workings

No. 1 TUNNEL

No. 2 TUNNEL

No. 1 EXTD. TUNNEL

MOUNT ELLIOTT

Dam

Bore

◎ N.S. 68
R.L. COLL. 152·75
R.L. SURF. 151·33
R.L. BTM. −23·25

◎ N.S. 60
R.L. COLL. 187·33
R.L. SURF. 185·63
R.L. BTM −35·66

◎ N.S. 63
R.L. COLL. 187·51
R.L. SURF. 186·01
R.L. BTM −55·32

A B C

2000 S. 4000 S. 6000 S.

2000 W. 4000 W.

CROSS SECTION X–X'

N.S.63 AIRSHAFT

Stone drive — *Limit of Mine workings*

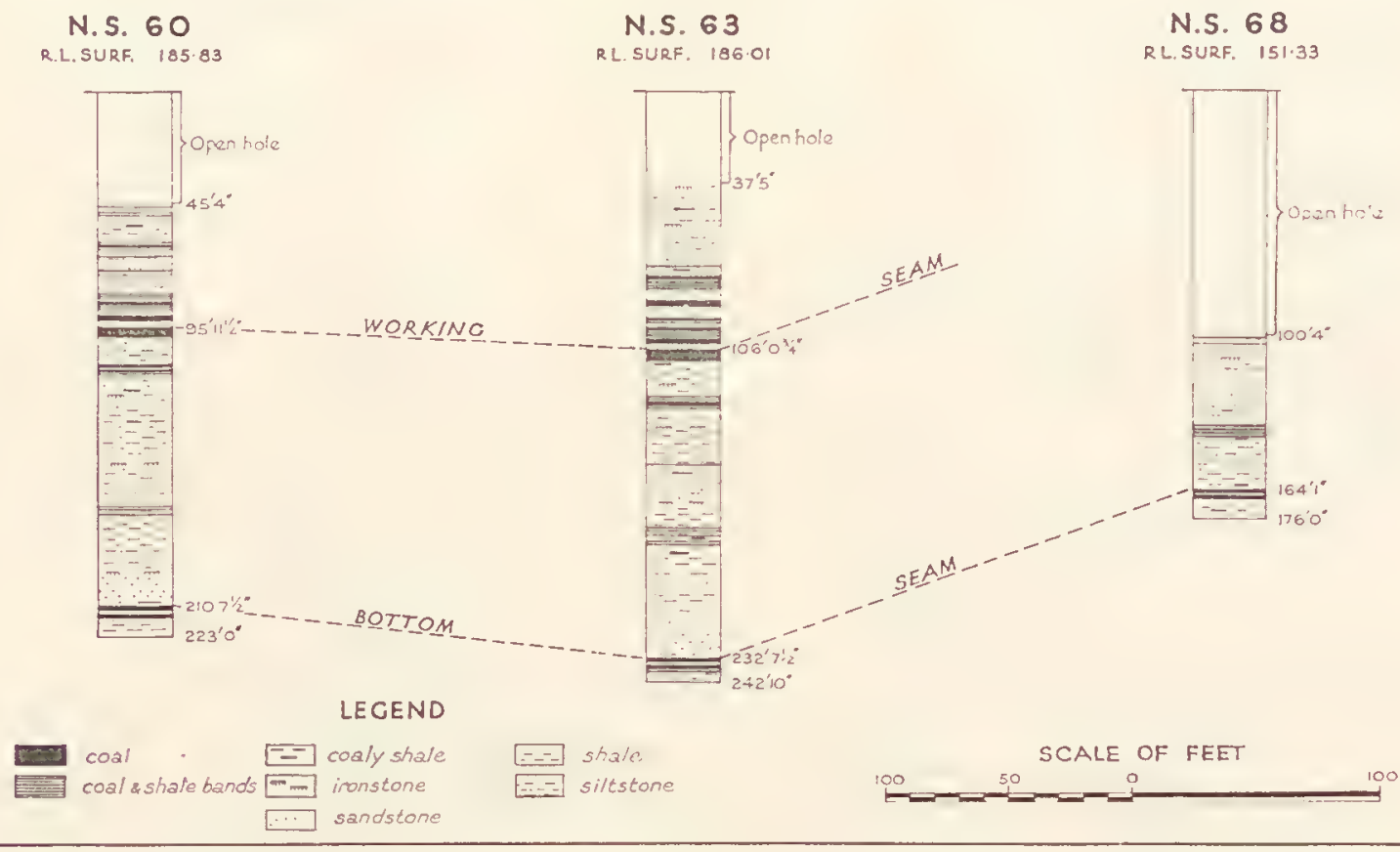
Top Seam

State datum

Bottom Seam

FIG. 3

MOUNT ELLIOTT — GENERALISED BORE SECTIONS



SUBSURFACE GEOLOGY

In boreholes N.S. 60 and N.S. 63 the top seam worked at Mount Elliott is overlain by 35 ft. of interbedded coal and shale bands with at least another 30 ft. of grey shale with a few thin coal plies above this. Although a definite succession within the overlying coaly measures can be recognised in each borehole, none of the seams exhibits a workable section over the area tested.

The **Top seam** or **Working seam** as it was previously called at Mount Elliott was cored in workable condition in both boreholes N.S. 60 and N.S. 63. As in the mine workings, the seam is 4-5 ft. thick with several thin bands of fawn shale (see fig. 4). The 2 ft. of coal which in some places lies only a few inches above the seam is in the area drilled split off by 2-3 ft. of shale.

In Mount Elliott No. 1 Extended tunnel, a 5 ft. seam of coal with several shale bands occurs 6 ft. below the top working seam. This seam was prospected also in No. 2 tunnel but according to reports was not workable. In boreholes N.S. 60 and N.S. 63 the seam was penetrated 10-15 ft. below the top seam; it is approximately 4 ft. thick including three shale bands totalling 12-18 in.

During deepening of the original airshaft of Mount Elliott No. 1 Extended Colliery, a workable seam of coal was encountered some 90 ft. below the working seam. This **Bottom seam** was tested by all three boreholes, N.S. 60, N.S. 63, and N.S. 68. The seam lies approximately 100 ft. below the upper group of seams, the intervening strata being shale with some sandstone and with one persistent but unworkable coal seam 20-40 ft. above. In the northern part of the area drilled, the Bottom seam is 4-5 ft. thick with a few thin bands of carbonaceous shale. To the south, however, around boreholes N.S. 60 and N.S. 63 the seam is split by a median band of shale 1 ft. 5 in. thick. Detailed sections are shown in fig. 4.

STRUCTURAL GEOLOGY

Within the Mount Elliott mine area the Walloon Coal Measures are more or less horizontally disposed. A study of mine plans, however, shows that the top seam workings occupy the northern portion of a shallow basin, the dip of the flanks nowhere exceeding 2 degrees. Whether this structure is only a local irregularity in the gently dipping sediments or part of a regional trend, is not yet known. Eastwards from Amberley there is an appreciable swing in the attitude of the Walloon beds from a southerly to a westerly dip.

For many years mining operations at Mount Elliott were unhampered by faulting. In 1955-56, however, a series of discontinuous faults with an east to east-south-east trend was encountered in all four dip sections of the colliery workings. As a rule, the faults were of the normal type, dipping to the north and with the upthrown side to the south. Displacement along the strike of these faults was very variable, changing in some places from a few inches to several feet in less than a chain. It was to locate and prove the working seam beyond this line of faulting that the emergency drilling at Mount Elliott was undertaken.

FIG. 4

MOUNT ELLIOTT

DIAGRAMS OF SEAMS — DETAILS OF CORE RECOVERY AND ANALYSIS

WORKING SEAM

N.S. 63

Prox Analysis S, Cal.value, SG.	Recovery percent	Section Sampled	Seam Section	Description
A.I. 14·9 S.G. 1·38	85%			Roof: sh.w.coal bands; 4" gy.wh.wavy sh;
			101'8½"	2'0"(p bkn) coal;
			103'9½"	2'3¾" l.gy.slts;
M.I. 6·3 VM.I. 38·5 FC.I. 40·0 A.I. 15·2 Joules/gm. 26,850 B.T.U./lb. 11,330 S.I. 0·45 S.G. 1·38	98·9%	Excl. Excl Excl. Excl	106'0¾"	7¾"(p b) coal, ¾" coaly sh; 10½"(p b) coal, 2½" fn sh; ¼" coaly sh; 6"(p b) coal w. 4" carb.sh. 4" fr.top; 1" carb sh.; 1'4¾"(p b) coal w.½" l.gy sh. 5" fr.top & w l.gy sh. lam. in btm. ½"; 1" gy-wh. sh; 9¾"(p b) coal w ¼" gy wh sh. 1" fr. btm;
			110'9½"	6" l.gy sh; 1" carb.sh; 2½" coal; ½" carb.sh.; ¾" m.gy sh; ¼" carb.sh; Floor: l.gy.sh.

Overall recovery 95%

N.S. 60

Prox.Analysis S.,Cal.value,S.G.	Recovery percent	Section Sampled	Seam Section	Description
			91'4¼"	Roof: sh.w.coal bands; 5" gy-wh.sh arenite;
A.I. 20·3 S.G. 1·42	68%			1'6¾"(part.bkn.) coal & inf.coal;
			93'1"	2'2" l.gy slts;
M.I. 7·4 VM.I. 36·9 FC.I. 40·1 A.I. 15·6 Joules/gm. 25,740 BTU/lb. 11,070 S.I. 0·55 S.G. 1·38	100%	Excl Excl Excl. Excl Excl Excl	95'11½"	8½" l.gy sh; 6½"(p b) coal; 1" carb sh. w coal lents; 5" coal — inf.coal; ¼" carb sh; 4½" inf.coal — coal; ¼" carb sh; 2¾" fn.sh; ½" carb sh; 4½"(p b) coal; ¼ d.gy.sh w tiny nod l.carb; 2"(b) coal; ¾" l.g.sh; 1'0½"(p b) coal; 1" l.gy.sh. w. coal lens; 6½"(p b) coal;
			100'1¼"	5¼" l.gy.sh. w. tiny nodules of iron carb; 1" carb sh. w. coal lents; 2"(b) coal; 2¾ carb sh. — d.gy.sh; 5¼" l.g.y sh; Floor: l.gy f sa,

Overall recovery 98·0%

MINE WORKINGS 'A'

M.I. 6·9 VM.I. 36·5 FC.I. 38·3 A.I. 17·9 Joules/gm. 25,290 BTU/lb. 10,880 S.I. 0·82 S.G. 1·384		4'9½" Excl Excl Excl Excl		Roof: l.gy sh; 5½" coal w ½" carb.sh. in mid; ½ coaly sh; 1'3¾" coal; 1'd gy sh w coal lents, 1" fn sh; 6" coal, 1'd gy sh, 3" coal, ¾" fn sh; 1'2½" coal w. ¼" l.gy sh. 6½" fr. top; 1" fn sh. w coal lenses; 7½" coal; Floor: l.gy.sh.;

MINE WORKINGS 'B'

M.I. 5·1 VM.I. 37·1 FC.I. 40·3 A.I. 14·5 Joules/gm 25640 BTU/lb. 11030 S.I. 0·54 S.G. 1·35		4'3½" Excl Excl		Roof: coal (approx. 6"); 1'5" coal w. ½" g.sh. 10" fr. top; NOT TO SCALE 2'5" l.gy sh; 1'8" coal; 2½" fn.sh; 1'9" coal w ½" carb.sh. 7" fr. top; ½" fn sh; 7½" coal; Floor: l.gy sh;

BOTTOM SEAM

N.S. 60

A.I. 15·0 S.G. 1·38	100%	Excl Excl	209'3"	Roof: l.gy f. arg. sa; 1'4" coaly sh; 1¼" coal; ½" carb.sh;
			210'7¾"	1'1½" m.gy.sh. — d.gy.sh. — carb.sh; 6" coal & inf.coal; 1" coaly sh; ¾" m.gy.sh; 1'6"(p b) coal & inf.coal w. 1" d.gy.sh. w tiny nodules of l.carb, 8¾" fr. top;
			212'0½"	1'4" carb sh;
A.I. 18·2 S.G. 1·38	100%		214'2½"	1'4" gy.sh; 13½"(p b) coal & inf.coal;
			215'6"	1'5½" carb sh w.coal lents. — coaly sh. in places in btm. 6"; Floor: m.gy sh..

Overall recovery 100%

N.S. 68

M.I. 5·5 VM.I. 38·8 FC.I. 39·8 A.I. 15·7 Joules/gm. 26,330 B.T.U./lb. 11,330 S.I. 0·57 S.G. 1·38	100%	Excl Excl	162'11¼"	Roof: gy.sh; 4½" coal; ½" carb.sh; 4¼" l.gy.sh.;
			164'1"	4'4" carb.sh; 1'1½"(p b) coal & inf.coal; 2½" carb.sh w tiny nodules of iron carb; 2'(bkn) coal; ¾" carb.sh; 4½" coal; 2¾" carb.sh; ½" inf.coal; ¾" m.gy.sh; 1'8¾"(p b) coal w. few carb.sh. lam. at 3" to 4";
			166'0½"	Floor: l.gy.sh;

Overall recovery 100%

N.S. 63

A.I. 14·1 S.G. 1·38	100%	Excl	232'11"	Roof: l.gy f.arg.sa; 3" inf.coal w ¼" concordant veins $CaCO_3$ at base; 1" carb sh; 4" l.m.gy sh; 2'0" d.gy sh; 3¾" carb sh; 1'm.gy sh; ¾" inf.coal w thin calcite veins, 6" coal; 1½ coaly sh; 1¼" coal, 1½ carb sh, 1'1½" coal w two ¼" carb sh bds at 2¼" & 3¼";
			234'6"	1'4" d.gy.sh. — carb.sh. in places; 2¼" coal & inf.coal; 5½" d.gy sh. — m.gy.sh;
A.I. 19·2 S.G. 1·41	100%		235'11¼"	¼" carb.sh.; 1" coal; ½" d.gy sh; 1'1¼"(p b) coal;
			237'0¾"	5¼" d.gy.sh — carb.sh.;
A.I. 32·3 S.G. 1·53	100%		237'6"	1'0¾" inf.coal & coal w num lam. & thin bds of coaly & carb sh;
			238'6¼"	3½" m.gy sh; ¼" carb sh; ½" inf.coal; 1½" carb.sh; Floor: sh.

Overall recovery 100%

MINE WORKINGS 'C'

M.I. 7·3 VM.I. 37·6 FC.I. 37·6 A.I. 17·5 Joules/gm 25210 BTU/lb. 10850 S.I. 0·65 S.G. 1·39		4'6" Excl Excl Excl		Roof; inf.coal, 1" coal, 1" carb.sh. w.coal lents; 1" d.gy.sh.; 6" coal; 2" carb.sh.; 9" coal. inf. in top 1"; 1" d.gy sh. w coal lents; 6" coal w. ½" carb.sh. 1½" fr. top; 4½" carb.sh.; 1½" carb.sh. w. ½" coal in middle; 2'0" coal w. ¼" carb sh. 8" fr. top; Floor: l.gy.sh.

The two boreholes N.S. 60 and N.S. 63, drilled no more than 10 chains south of the mine workings, indicated that the overall upthrow of the seam beyond the line of faulting was no more than 20 ft. A stone rise with a grade of 1 in 12 was subsequently driven in the No. 3 dip section of the colliery towards N.S. 63. Two normal faults with upthrow to the south and a third with downthrow to the south were penetrated before the working seam was encountered. In the No. 4 dip workings to the east, where the faulting has also been penetrated, a similar series of parallel faults has been proved. To the south beyond this zone of faulting which is up to 2 chains wide the seam is apparently undisturbed.

COAL RESOURCES

Both measured and indicated reserves have been calculated. To be included in either of these categories, a seam section must satisfy the following arbitrary conditions:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content after exclusion of stone bands normally removed in practice of not more than 25 per cent. Reserve areas have been defined as extending no more than five chains from peripheral points of observation (diamond drill holes or mine workings). The status of these reserves depends on the distance between observation points:

(*a*) up to 12½ chains—measured reserves.

(*b*) more than 12½ chains—indicated reserves.

Measured reserves established by the drilling programme in the **Top** (previously Working) **seam** extend over 27 acres and amount to 185,000 tons. In this area, which is south of the zone of faulting, the seam ranges in thickness from 4 ft. 2 in. to 4 ft. 9 in. Average thickness of coal is 4 ft. 0½ in. The weighted average ash is 15·8 per cent.

In the **Bottom seam** both measured and indicated reserves have been estimated. The measured reserves lie in two areas—a northern area of 21 acres between the new workings and borehole N.S. 68; and a southern area of 19 acres around boreholes N.S. 60 and N.S. 63. The northern reserves total 125,000 tons with a weighted average ash content of 16·6 per cent. Average seam thickness is 4 ft. 3 in. including 3 ft. 7 in. of coal. The reserves to the south total 97,000 tons with a weighted average ash content of 16·2 per cent. The average seam thickness is 4 ft. 8 in. including 3 ft. 0½ in. of coal, the increase in seam thickness being due to thickening of a median shale band up to 1 ft. 5 in. Between these two areas, indicated reserves totalling 90,000 tons with a weighted average ash content of 16·4 per cent. have been estimated.

CONCLUSIONS

The emergency diamond drilling programme carried out in the Mount Elliott mine area in 1956 established that the Top seam was workable beyond the zone of faulting which was then hindering development and that the overall upthrow to the south was no more than 20 ft. Workable coal was also proved in the Bottom seam which was first encountered during deepening of the original airshaft of Mount Elliott No. 1 Extended Colliery.

The following reserves were established by the drilling programme:—

	Tons
Top Seam—	
Measured Reserves	185,000
Bottom Seam—	
Measured Reserves—	
Northern area	125,000
Southern area	97,000
Indicated Reserves	90,000
Total	497,000

REFERENCES

CAMERON, J. B., 1959: Coal resources—Rosewood-Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

24th August, 1959.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(MOUNT ELLIOTT MINE AREA—EXTENSION)

By J. B. CAMERON

SUMMARY

A diamond drilling programme, initiated to prove reserves in the two working seams, was extended to include two underlying seams in which early drilling showed workable sections.

In all, thirty-three holes were drilled in the area, aggregate footage being 8,220 ft. 6 in.

Correlation of the seam succession in the area with that in the main part of the field has been made.

As a result of the diamond drilling, measured reserves have been established in four seams as follows:—

	Tons
Top Working seam	545,000
Bottom Working seam	265,000
Moorefield No. 3 Bottom seam	1,080,000
Lowfield seam	670,000
Total	2,560,000

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

In 1956 three diamond drill holes, N.S. 60, N.S. 63, and N.S. 68, were drilled by the Department of Mines in the Mount Elliott mine area; the results of that emergency diamond drilling were assessed by Cameron (1963). A more extensive programme of coal exploration was undertaken by the Department in this area from September, 1960, to April, 1961, when a further thirty holes, N.S. 196-216 and N.S. 218-226, were drilled by the Mindrill F20 plant. Aggregate footage drilled in this programme was 7,578 ft. 8 in., overall core recovery being 93·9 per cent. Due to poor recovery in coal seams in boreholes N.S. 198 and N.S. 209 and because of faulting near borehole N.S. 200, an additional hole was drilled at each of those sites—N.S. 208, redrill of N.S. 198; N.S. 210, redrill of N.S. 209; and N.S. 201, redrill of N.S. 200.

Workable coal sections encountered during the drilling programme were examined by a representative of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone both underground and on the surface. All analyses were carried out by the Government Chemical Laboratory. Seam correlation is based on geological work carried out by the writer since 1956.

Accompanying this report are the following plans, sections and diagrams: —

(*a*) Locality Plan—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, and surface contours at 10 ft. intervals and underground levels on State Datum—fig. 2.

(*c*) Plan showing points of observation and boundaries of measured reserves—fig. 3.

(*d*) Generalised bore sections—figs. 4-6.

(*e*) Diagrams of seams showing sections analysed and results:—
Top Working Seam—fig. 7.
Bottom Working Seam—fig. 8.
Moorefield No. 3 Bottom Seam—figs. 9-10.
Lowfield Seam—fig. 11.

(*f*) Two cross sections—fig. 12.

MINE WORKINGS

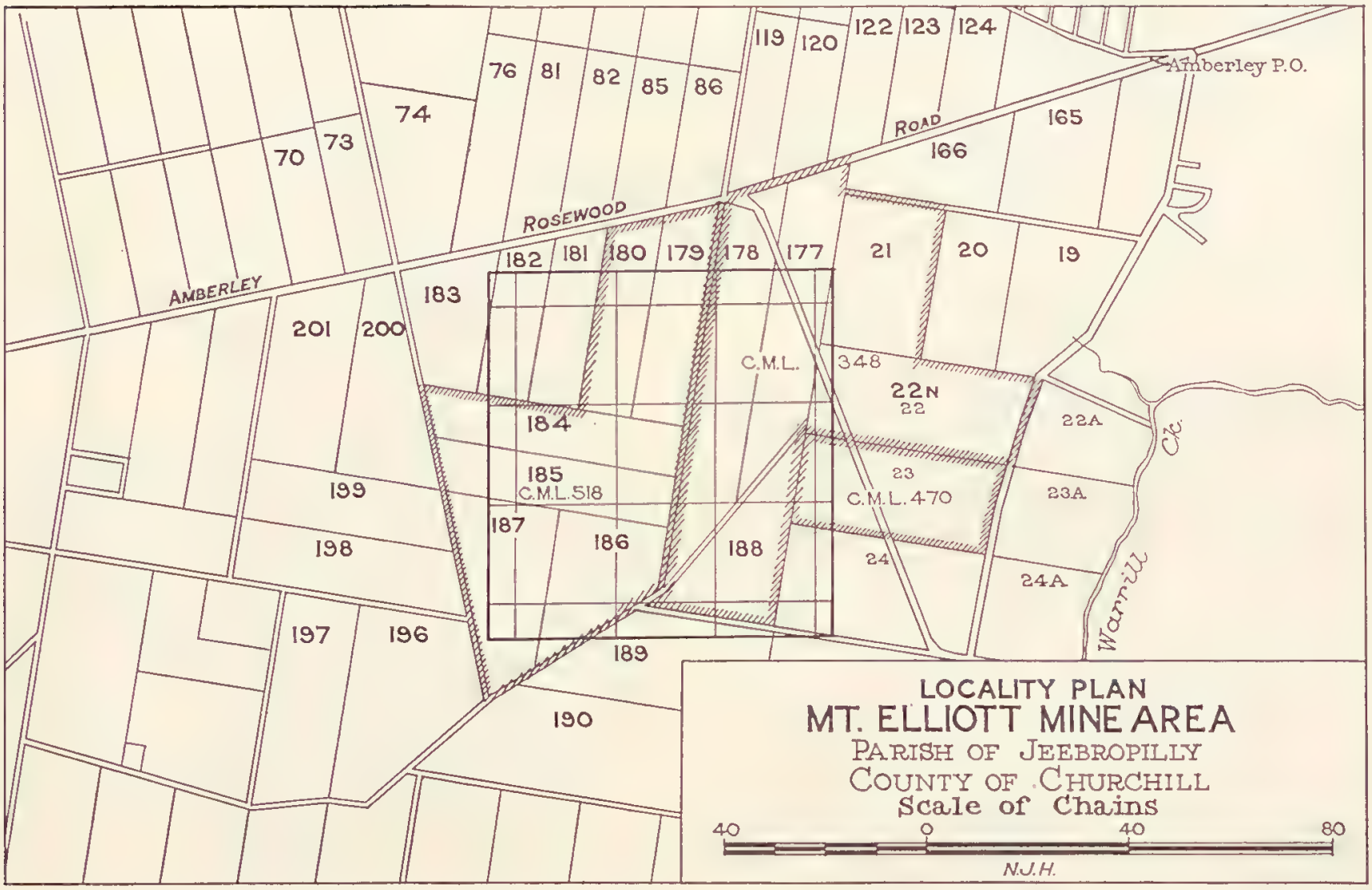
Mount Elliott No. 1 Extended Colliery is situated 1½ miles west-south-west of Amberley Post Office (see fig. 1) and approximately 5 miles east of Rosewood. The workings lie within Coal Mining Lease (Application) No. 518 and C.M.L. No. 348 held, along with C.M.L. No. 470, by Philip Bernard Fallu and party, trading as Mount Elliott Coal Company.

At present two seams some 90 ft. apart are being exploited. The Top seam has been worked in this area for nearly thirty years, the early production coming from the now abandoned Mount Elliott Nos. 1 and 2 Collieries. The Bottom seam, on the other hand, has been worked only for the past four years from the No. 1 Extended tunnel.

SUBSURFACE GEOLOGY

The 1960-61 programme of diamond drilling in the Mount Elliott mine area has shown that the total thickness of coal-bearing strata within the Walloon Coal Measures as developed in this part of the coalfield is approximately 480 ft. The upper 200 ft. of this sequence which includes the Top and Bottom Working seams has already been described (Cameron, 1963). In the remaining 280 ft. another two workable seams have been penetrated; these can be correlated with the Bottom seam worked at Moorefield No. 3 Colliery almost a mile to the north-north-west and the Lowfield seam (Cameron, 1962).

FIG. 1



In the most southerly workings of Mount Elliott No. 1 Extended Colliery, the **Top Working seam** which is now being exploited by longwall methods is about 4½ ft. thick with several thin shale bands totalling 6 in. Similar sections were penetrated in this seam in most of the boreholes drilled ahead of these places, the only deterioration detected being in the "tops" of the seam in borehole N.S. 208 to the west and boreholes N.S. 204-205 to the east (see fig. 7). In the extreme south of the mine area, however, around boreholes N.S. 201-202 and N.S. 206, the Top Working seam has been upthrown approximately 100 ft. This major fault will limit colliery development in this direction.

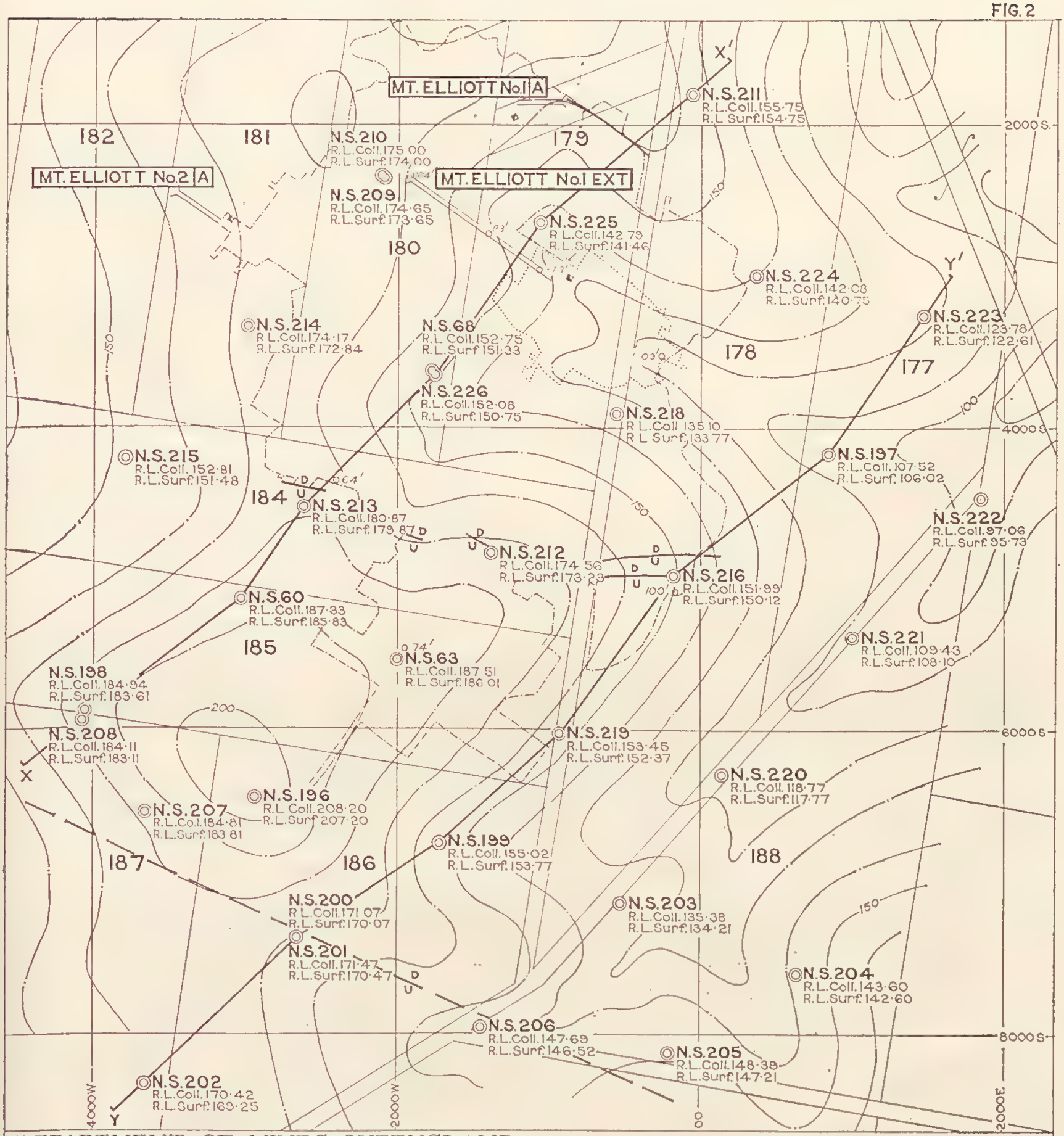
Prior to the commencement of the 1960-61 diamond drilling programme, the limit of workability in the **Bottom Working seam** had been reached in both the eastern and northern parts of the colliery. The deterioration in the working section in these areas was due to the growth of a median shale band to over 2 ft. Similar splitting was evident in boreholes N.S. 60 and N.S. 63 and was encountered in most of the holes designed to test this seam during the recent exploratory drilling. In fact, workable sections were penetrated in the Bottom Working seam only in boreholes N.S. 212-213 (see fig. 8) which were sited within an area of indicated coal (Cameron, 1963).

The Moorefield No. 3 Bottom seam lies usually about 70 ft. below the Bottom Working seam although to the north around boreholes N.S. 209 and N.S. 211 the interval is 100-120 ft. The intervening strata are light grey shale, siltstone and fine sandstone with several persistent but unworkable coal seams the top-most of which can be correlated with the Top seam of Moorefield No. 3 Colliery and also with the working seam of the adjacent Coalfields Colliery. This **Moorefield No. 3 Top seam** is of no economic interest in the Mount Elliott mine area, comprising as it does two or sometimes three coal plies 1-2 ft. thick separated, in most cases, by thick shale interbeds (see figs. 4-6). In borehole N.S. 197, however, the seam is 4 ft. 8 in. thick including 3 ft. 6 in. of coal but this was the only workable section encountered in the mine area.

Workable sections were penetrated in the **Moorefield No. 3 Bottom seam** in the Mount Elliott mine area in all holes drilled to test it, a total of eighteen boreholes. The seam which lies some 30-40 ft. beneath the Moorefield No. 3 Top seam ranges in thickness from 3 ft. 6¼ in. (N.S. 214) to 6 ft. 2½ in. (N.S. 221) and includes two persistent fawn shale bands, one less than 12 in. from the roof and the other only a few inches from the floor. Detailed seam sections of the Moorefield No. 3 Bottom seam are shown in figs. 9-10.

The Moorefield No. 3 Top and Bottom seams in the Amberley district can be equated on stratigraphic grounds with the United No. 8 Top and Bottom seams which are well developed in the Perry's Knob area of

FIG. 2



DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

MT. ELLIOTT MINE AREA

ROSEWOOD COALFIELD

Parish of Jeebropilly County of Churchill

Showing boreholes, mine workings & topography

To accompany report by J.B.Cameron B.Sc.App.(Geol.)

Scale of Chains

5 0 5 10 15

Twenty chain grid on True North. Point of origin, Peg in road at station 18 near N.E. corner, Por 179

LEGEND

Colliery (working)	NEATH	Colliery (abandoned)	NEATHIA
Shaft		Diamond drillhole	N.S.1
Fault, position accurate		Adit	
" " approx.		Seam section measured	A
Surface contours	50	Cross section line	X — X'

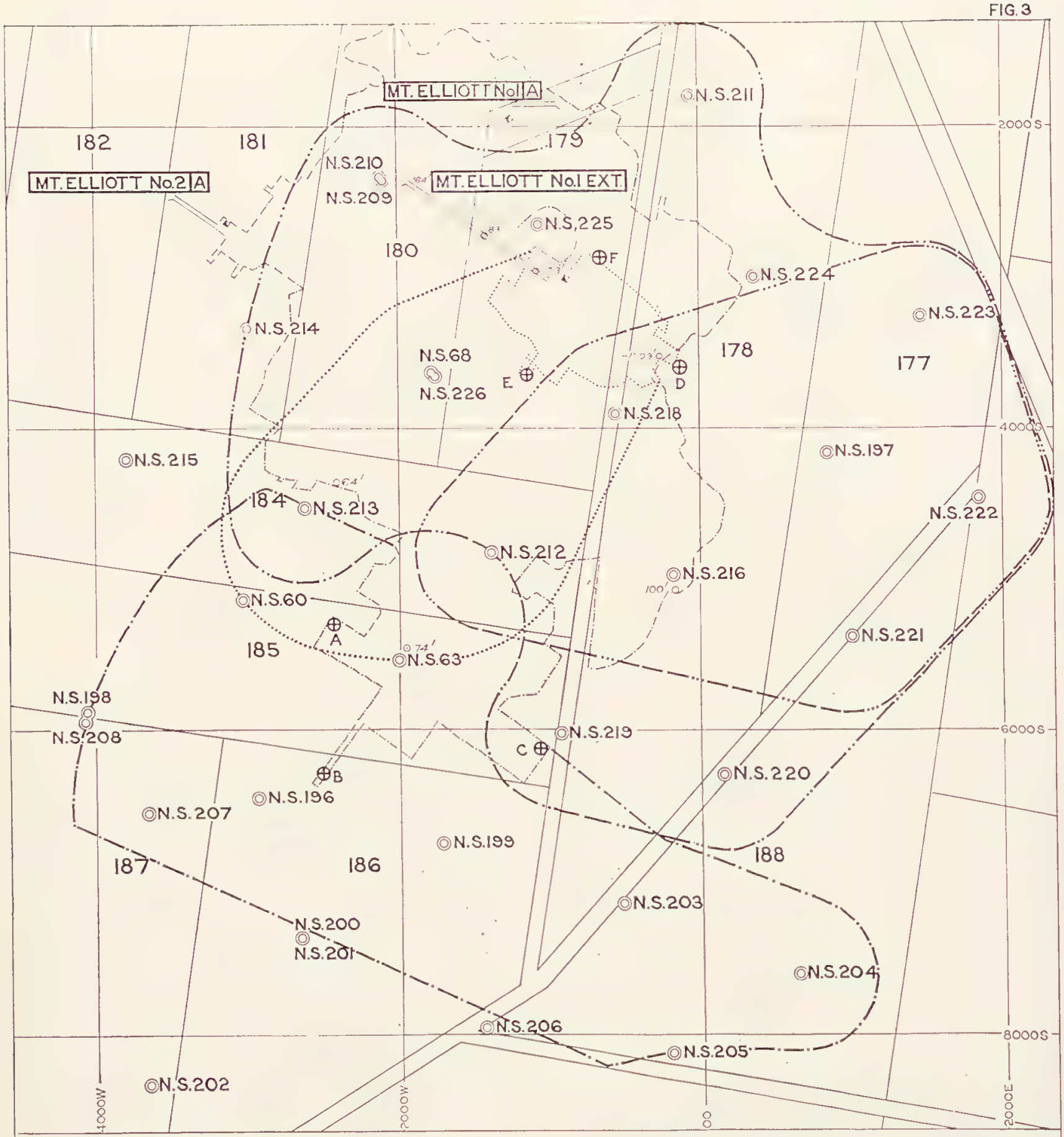
Elevations taken from mine plans & reduced to State Datum ⊙ 27'

Limits of mine workings :–

Top working seam ·—·—·—·

Bottom working seam ·····

FIG. 3



MT ELLIOTT MINE AREA

PLAN SHOWING

mine workings, points of observation, & boundaries of measured reserves

Scale of Chains

5 0 5 10 15

LEGEND

Colliery (working) NEATH Colliery (abandoned) NEATH A

Seam section measured ⊕A Diamond drillhole ◎N.S.1

Limits of mine workings:—

Top working seam

Bottom working seam

Boundaries of measured reserves:—

Top working seam

Bottom working seam

Moorefield No.3 btm. seam

Lowfield seam

N.J.H.

FIG. 4

MT. ELLIOTT MINE AREA—GENERALISED BORE SECTIONS

SCALE OF FEET 0 50 100

N.S.201 R.L. Coll. 171·47
N.S.202 R.L. Coll. 170·42
N.S.203 R.L. Coll. 135·38
N.S.204 R.L. Coll. 143·60
N.S.205 R.L. Coll. 148·39
N.S.200 R.L. Coll. 171·07
N.S.199 R.L. Coll. 155·02
N.S.198 R.L. Coll. 184·94
N.S.197 R.L. Coll. 107·52
N.S.196 R.L. Coll. 208·20

Open Hole
No Recovery
WORKING
SEAM
TOP
BOTTOM
No 3
LOWFIELD
MOOREFIELD

Walloon Coal Measures
Marburg Sandstone

LEGEND
Sandstone
Pebbly Sandstone
Shale
Siltstone
Iron carbonate
Thin Limestone beds
Coal
Coal with shale bands
Shale with coal bands
Fault Breccia

FIG. 5

MT. ELLIOTT MINE AREA—GENERALISED BORE SECTIONS

SCALE OF FEET

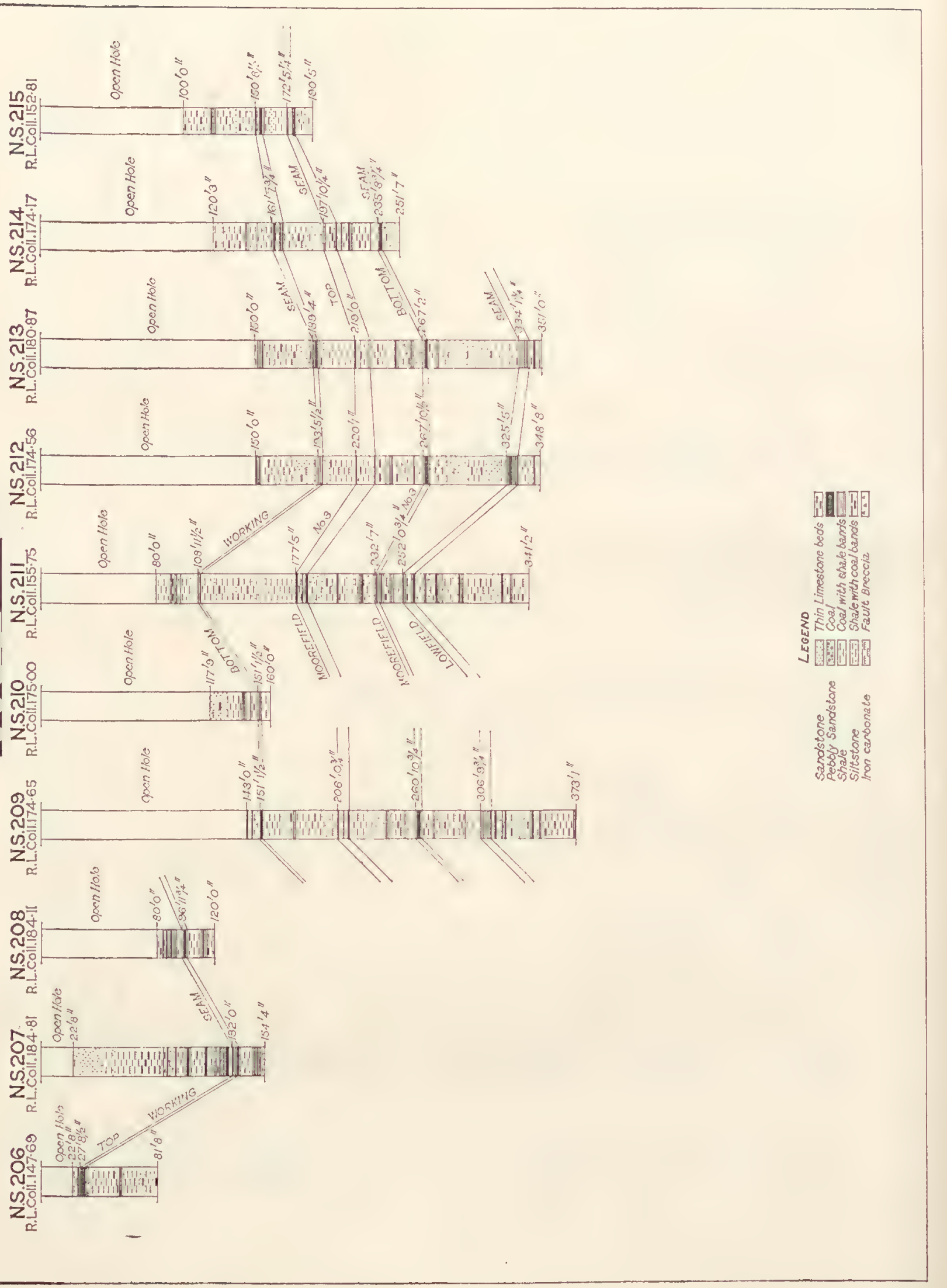


FIG. 6

MT. ELLIOTT MINE AREA—GENERALISED BORE SECTIONS

SCALE OF FEET 0 50 100

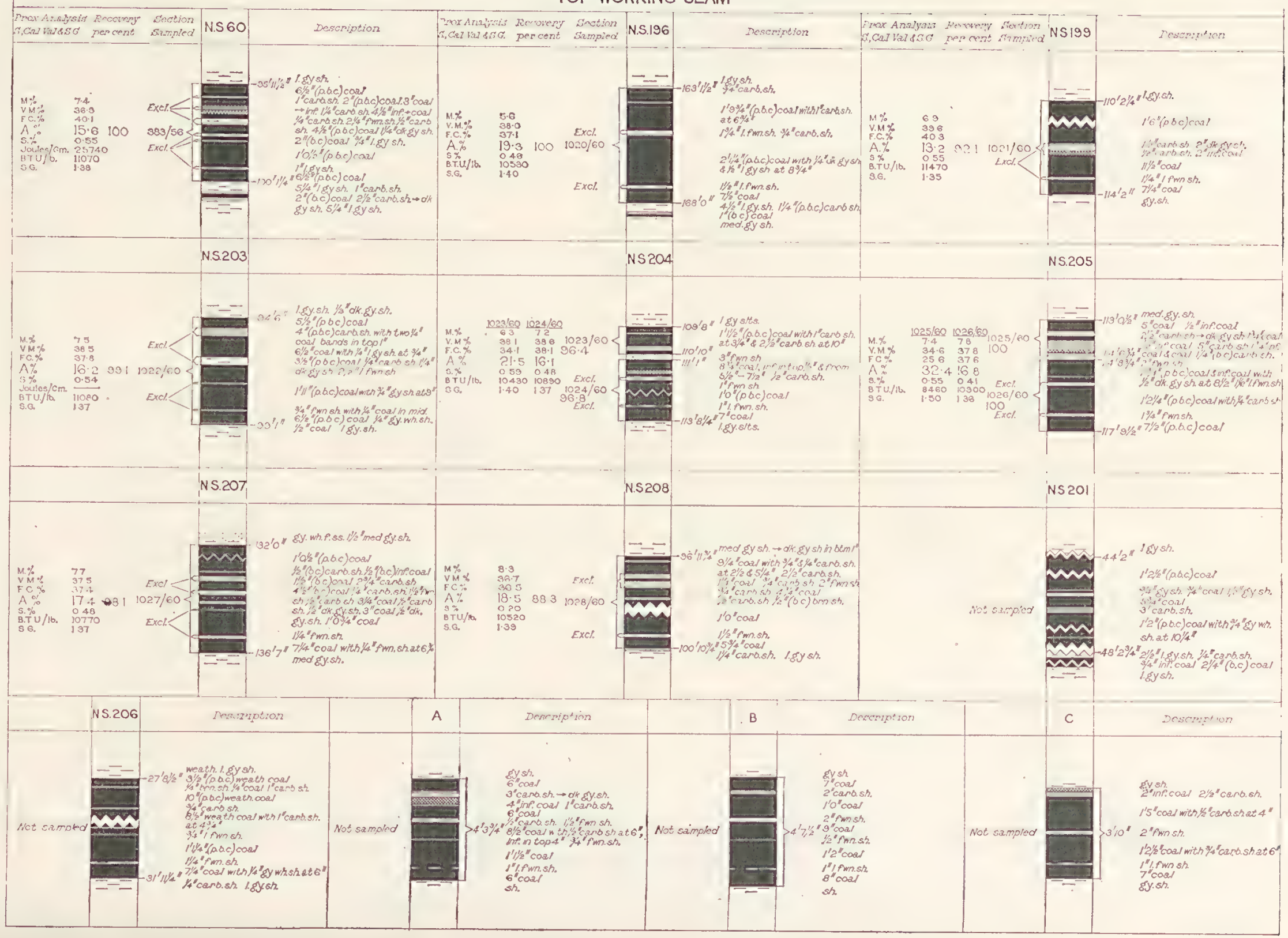
N.S.216 R.L. Coll. 151·99
N.S.218 R.L. Coll. 135·10
N.S.219 R.L. Coll. 153·45
N.S.220 R.L. Coll. 118·77
N.S.221 R.L. Coll. 109·43
N.S.222 R.L. Coll. 97·06
N.S.223 R.L. Coll. 123·78
N.S.224 R.L. Coll. 142·08
N.S.225 R.L. Coll. 142·79
N.S.226 R.L. Coll. 152·08

Open Hole
100'0"
BOTTOM SEAM 165'9"
192'11½"
234'3" No Recovery 240'7" 246'7¼"
294'10½"
318'8"
WORKING SEAM
200'0"
234'6¼"
262'4½"
292'10"
SEAM
MOOREFIELD
250'0"
281'6½"
335'2"
356'6"
Open Hole
22'8"
28'4½" No Rec.
32'9½"
75'6"
No 3 SEAM
217'7"
221'9¾" No 4 MOOREFIELD
258'9½"
LOWFIELD
315'11"
334'6"
Open Hole
200'0"
207'11"
TOP SEAM 150'0"
154'9"
204'0½"
218'8"
267'2½"
293'9"
Open Hole
150'0" SEAM
181'6¾"
197'4¾"
245'0"
Open Hole
175'0"
215'6¼"
237'6¼"
249'8"
Open Hole
200'0"
232'5½"
280'3¾"
308'4"
Open Hole
218'6"
240'1"
302'0¾"
331'1"

LEGEND
Thin Limestone beds
Coal
Coal with shale bands
Shale with coal bands
Fault Breccia
Sandstone
Pebbly Sandstone
Shale
Siltstone
Iron carbonate

FIG. 7

MT. ELLIOTT MINE AREA–DETAILED SEAM SECTIONS
TOP WORKING SEAM


N.S 60
Prox Analysis M,Cal Val &SG
Recovery per cent
Section Sampled
Description
M % 7·4
V M % 36·8
F C % 40·1
A % 15·6
S % 0·55
Joules/cm. 25740
BTU/lb. 11070
S G. 1·38
100
383/56
Excl.
Excl.
-35'11½" 1.gy.sh. 6½"(p.b.c)coal 1"carb.sh. 2"(p.b.c)coal 1.3"coal → inf. 1¼"carb.sh. 4½"inf.→coal ¼"carb.sh. 2¼"fwn.sh. ½"carb sh. 4½"(p.b.c)coal 1¼"dk.gy.sh. 2"(b.c)coal ¾"1.gy.sh. 1'0½"(p.b.c)coal 1"1.gy.sh. -100'1¼" 6½"(p.b.c)coal 5¼"1.gy.sh. 1"carb.sh. 2"(b.c)coal 2½"carb.sh.→dk gy.sh. 5¼"1.gy.sh.
N.S.203
M % 7·5
V M % 38·5
F C % 37·8
A % 16·2
S % 0·54
Joules/cm. 11080
BTU/lb. 11137
S G. 1·37
99·1
1022/60
Excl.
Excl.
-94'6" 1.gy.sh. 1½"dk.gy.sh. 5½"(p.b.c)coal 4"(p.b.c)carb.sh. with two ¼" coal bands in top 1" 6½"coal with ¼"1.gy.sh. at ¾" 3½"(p.b.c)coal ¼"carb.sh. 1¼" dk.gy.sh. 2.2"1.fwn.sh 1'11"(p.b.c)coal with ¾"gy.sh. at 9" ¾"1.fwn.sh. with ¼"coal in mid. -99'1" 6½"(p.b.c)coal ¼"gy.wh.sh. ½"coal 1.gy.sh.
N.S.207
M % 7·7
V M % 37·5
F C % 37·4
A % 17·4
S % 0·48
B.T.U/lb. 10770
S G. 1·37
98·1
1027/60
Excl
Excl.
-132'0" gy.wh.f.ss. 1½"med gy.sh. 1'0½"(p.b.c)coal ½"(b.c)carb.sh. ½"(b.c)inf.coal 1½"(b.c)coal 2"¾"carb.sh 4½"(b.c)coal ¼"carb.sh. 1½"fwn sh ½"carb sh ¾"coal ½"carb sh. ½"dk.gy.sh. 3"coal ½"dk. gy.sh. 1'0¾"coal 1¼"fwn.sh. -136'7" 7¼"coal with ¼"fwn.sh at 6½" med gy.sh.
N.S.206
Not sampled
-27'8½" weath. 1.gy.sh. 3½"(p.b.c)weath coal ¼"brn.sh. ¼"coal 1"carb sh 10"(p.b.c)weath.coal ¾"carb.sh. 8½"weath coal with 1"carb.sh. at 4¾" ¾"1.fwn.sh. 1'1¼"(p.b.c)coal 1¼"fwn.sh. -31'11½" 7¼"coal with ¼"gy wh.sh at 6" ¼"carb.sh. 1.gy.sh.
N.S.196
Prox Analysis M,Cal Val &SG
Recovery per cent
Section Sampled
M % 5·6
V M % 38·0
F C % 37·1
A % 19·3
S % 0·48
B.T.U/lb. 10580
S G. 1·40
100
1020/60
Excl.
Excl.
-163'1½" 1.gy.sh. ¾"carb.sh. 1'9¾"(p.b.c)coal with 1"carb.sh. at 6¾" 1¾"1.fwn.sh. ¾"carb.sh. 2¼"(p.b.c)coal with ¼"dk.gy.sh & ½"1.gy.sh at 8¾" 1½"1.fwn.sh. 7½"coal 4½"1.gy.sh. 1¼"(p.b.c)carb.sh. 1"(b.c)coal med.gy.sh. -168'0"
N.S.204
1023/60 1024/60
M % 6·3 7·2
V M % 38·1 38·6 1023/60
F C % 34·1 38·1 96·4
A % 21·5 16·1
S % 0·59 0·48
B.T.U/lb. 10430 10890 Excl.
S G. 1·40 1·37 1024/60 96·8 Excl.
-109'8" 1.gy.slts. 1'1½"(p.b.c)coal with 1"carb.sh. at 3¾" & 2½"carb.sh at 10" -110'10" -111'1" 3"fwn.sh 8¼"coal, inf. in top ½" & from 5½"-7½" ½"carb.sh. 1"fwn.sh. 1'0"(p.b.c)coal 1"1.fwn.sh. -113'8¼" 7"coal 1.gy.slts.
N.S.208
M % 8·3
V M % 36·7
F C % 36·5
A % 18·5
S % 0·20
BTU/lb. 10520
S.G. 1·39
88·3
1028/60
Excl.
Excl.
-96'11¾" med gy.sh.→dk.gy.sh in btm 1" 9¼"coal with ¾"&½"carb.sh. at 2½ & 5¼" 2½"carb.sh. 1¼"coal ¼"carb sh 2"fwn sh ¾"carb sh 4¼"coal ½"carb.sh ½"(b.c)brn.sh. 1'0"coal 1½"fwn.sh. -100'10¾" 5¾"coal 1¼"carb.sh. 1.gy.sh.
A
Not sampled
-4'3¾" gy.sh. 6"coal 3"carb.sh.→dk gy.sh. 4"inf. coal 1"carb.sh. 6"coal ½"carb.sh. 1½"fwn sh. 8½"coal with ½"carb sh at 6", inf. in top 4" ¾"fwn.sh. 1'1½"coal 1"1.fwn.sh. 6"coal sh.
B
Not sampled
-4'7½" gy.sh 7"coal 2"carb.sh. 1'0"coal 2"fwn.sh. 9"coal ½"fwn.sh. 1'2"coal 1"1.fwn.sh. 8"coal sh.
C
Not sampled
-3'10" gy.sh. 2"inf.coal 2½"carb.sh. 1'5"coal with ½"carb.sh at 4" 2"fwn.sh. 1'2½"coal with ¾"carb.sh at 6" 1"1.fwn.sh. 7"coal gy.sh.
N.S 199
Prox Analysis M,Cal Val &SG
Recovery per cent
Section Sampled
M % 6·9
V M % 39·6
F C % 40·3
A % 13·2
S % 0·55
B.T.U/lb. 11470
S G. 1·35
99·1
1021/60
Excl.
-110'2¼" 1.gy.sh. 1'6"(p.b.c)coal 1¼"carb.sh. 2"dk.gy.sh. ½"carb.sh. 2"inf.coal 1½"coal 1¼"1.fwn.sh. -114'2" 7¼"coal gy.sh.
N.S.205
1025/60 1026/60
M % 7·4 7·8
V M % 34·6 37·8 1025/60
F C % 25·6 37·6 100
A % 32·4 16·8
S % 0·55 0·41 Excl.
B.T.U/lb. 8460 10900 1026/60
S G. 1·50 1·38 100 Excl.
-113'0½" med.gy.sh. 5"coal ½"inf.coal 6½"carb sh→dk gy sh 1¼"coal 1'4"6¾" coal & coal 1¼"(b.c)carb.sh. 4'8¾" 2"fwn.sh. 1"(p.b.c)coal & inf.coal with ½"dk.gy.sh. at 6½" 1½"1.fwn.sh 1'2¼"(p.b.c)coal with ¼"carb sh 1¾"fwn.sh. -117'9½" 7½"(p.b.c)coal
N.S 201
Not sampled
-44'2" 1.gy.sh. 1'2½"(p.b.c)coal ¾"gy.sh. ¾"coal 1¼"gy.sh. 5¾"coal 3"carb.sh. 1'2"(p.b.c)coal with ¾"gy wh. sh. at 10¼" -48'2¾" 2½"1.gy.sh. ¼"carb.sh. ¾"inf.coal 2¼"(b.c)coal 1.gy.sh.

MT. ELLIOTT MINE AREA–DETAILED SEAM SECTIONS
BOTTOM WORKING SEAM

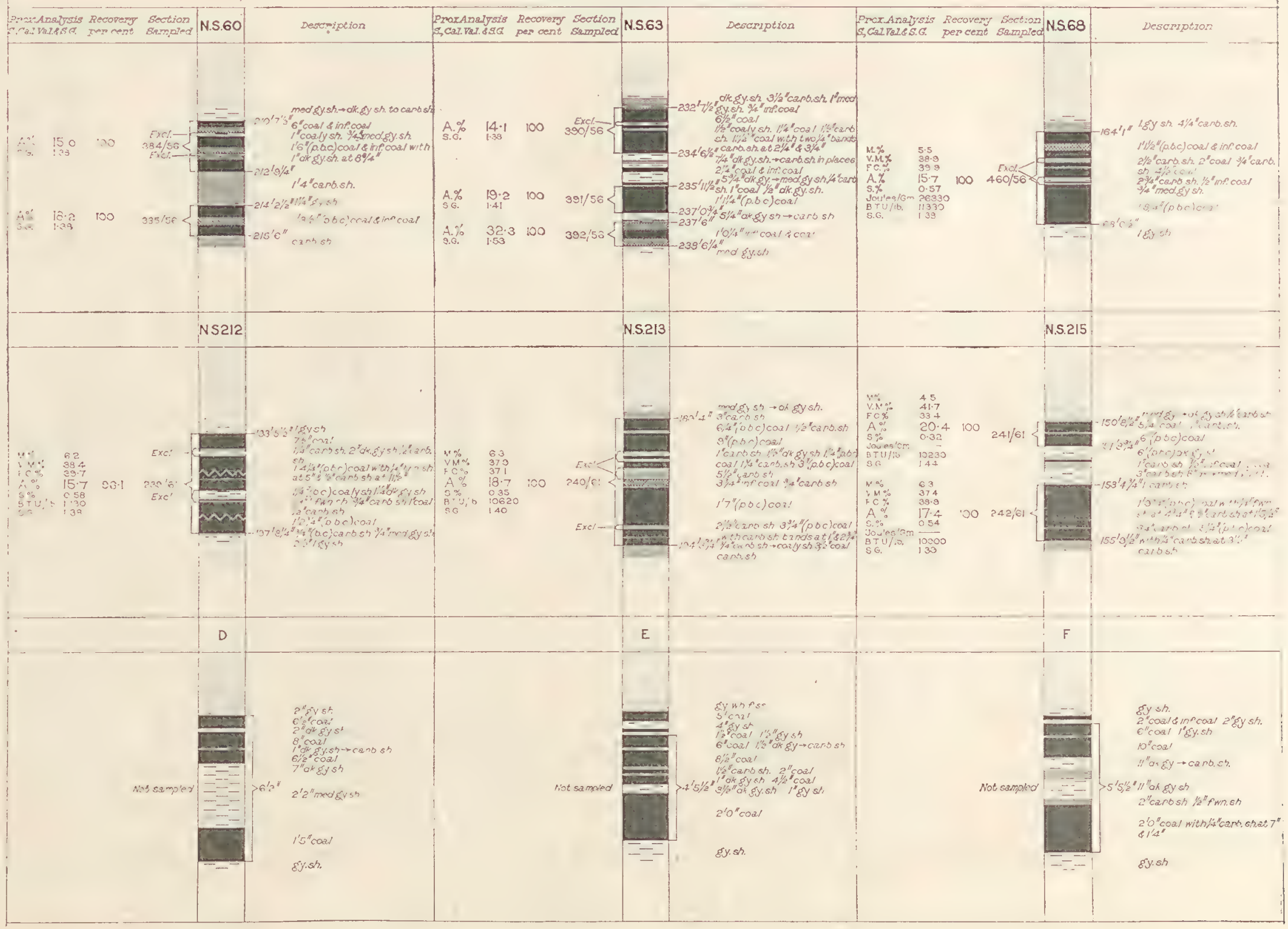

Prox. Analysis S, Cal. Val. & S.G.
Recovery per cent
Section Sampled
N.S.60
Description
med.gy.sh.→dk.gy.sh. to carb.sh
210'7⅓" 6" coal & inf. coal
1" coal y.sh. ¾" med.gy.sh.
1'6" (p.b.c) coal & inf. coal with
1" dk.gy.sh. at 8¼"
212'9¼" 1'4" carb.sh.
214'2½" 1¼" gy.sh
¾" p.b.c) coal & inf. coal
216'6" carb.sh
A.% 15.0 S.G. 1.38 100 Excl. 384/56 Excl.
A.% 18.2 S.G. 1.39 100 385/56
N.S.212
N.S.213
N.S.215
A.% 14.1 S.G. 1.38 100 Excl. 390/56
A.% 19.2 S.G. 1.41 100 391/56
A.% 32.3 S.G. 1.53 100 392/56
232'1½" dk.gy.sh. 3½" carb.sh. 1" med gy.sh. ¾" inf. coal 6½" coal 1½" coal y.sh. 1¼" coal 1½" carb. sh. 1½" coal with two ¼" bands
234'6½" carb.sh. at 2¼" & 3¼" 7¼" dk.gy.sh.→carb.sh. in places 2¼" coal & inf. coal
235'11½" 5¾" dk.gy.→med.gy.sh. ¼" carb
237'0¾" 1'1¼" (p.b.c) coal
237'6" 5¼" dk.gy.sh.→carb.sh
239'6¼" 1'0¼" inf. coal & coal
med.gy.sh
M.% 5.5 V.M.% 38.9 F.C.% 39.9 A.% 15.7 S.% 0.57 Joules/Gm 26330 BTU/lb. 11330 S.G. 1.38 100 Excl. 460/56
164'1" 1.gy.sh. 4¼" carb.sh.
1'1½" (p.b.c) coal & inf. coal
2½" carb.sh. 2" coal ¾" carb. sh. 4½" coal
2¾" carb.sh. ½" inf. coal ¾" med.gy.sh.
1'8¼" (p.b.c) coal
169'0½" 1.gy.sh
M.% 6.2 V.M.% 38.4 F.C.% 39.7 A.% 15.7 S.% 0.58 BTU/lb. 11.30 S.G. 1.38 99.1 Excl. 339/61 Excl.
133'5½" 1'gy.sh 7½" coal 1¼" carb.sh. 2" dk.gy.sh. ½" carb. sh 1'4¼" (p.b.c) coal with ¼" gy.sh at 5" & ½" carb.sh at 11½" 1¼" (p.b.c) coal y.sh 1'4½" gy.sh 4½" fwn.sh ¾" carb.sh 1 coal 2" carb.sh 1'2¾" (p.b.c) coal
137'8¼" ¾" (p.b.c) carb.sh ¾" med.gy.sh 2'3" 1.gy.sh
M.% 6.3 V.M.% 37.9 F.C.% 37.1 A.% 18.7 S.% 0.35 BTU/lb 10620 S.G. 1.40 100 Excl. 240/61
184'1¼" med.gy.sh.→dk.gy.sh. 3" carb.sh. 6¼" (p.b.c) coal ½" carb.sh 9" (p.b.c) coal 1' carb.sh 1½" dk.gy.sh 1¼" p.b.c coal 1¼" carb.sh 3" (p.b.c) coal 5½" carb.sh 3¾" inf. coal ¾" carb.sh 1'7" (p.b.c) coal 2½" carb.sh 3¾" (p.b.c) coal with carb.sh. bands at 1" & 2¾" 194'3¾" ¼" carb.sh.→coal y.sh. 3½" coal carb.sh
M.% 4.5 V.M.% 41.7 F.C.% 33.4 A.% 20.4 S.% 0.32 Joules/Gm — BTU/lb. 10230 S.G. 1.44 100 241/61
M.% 6.3 V.M.% 37.4 F.C.% 38.9 A.% 17.4 S.% 0.54 Joules/Gm — BTU/lb. 10300 S.G. 1.39 100 242/61
150'6½" 1" med.gy.→dk.gy.sh. ¼" carb.sh 5¼" coal 1" carb.sh.
2'3¾" 6" (p.b.c) coal 6" dk.gy. 1" carb.sh ½" inf. coal 3" coal 6" med.gy.sh.
153'4¾" 1" carb.sh
1'3" (p.b.c) coal with ¼" fwn. & at 4¾" & 8" carb.sh at 1½" 3¼" carb.sh at 5½" (p.b.c) coal
155'0½" with ¼" carb.sh at 3½" carb.sh
D
E
F
Not sampled
6½"
2" gy.sh. 6½" coal 2" dk.gy.sh. 8" coal 1" dk.gy.sh.→carb.sh 6½" coal 7" dk.gy.sh
2'2" med.gy.sh
1'5" coal
gy.sh.
Not sampled
4'5½"
gy. with fss 5" coal 4" gy.sh. 1½" coal 1½" gy.sh 6" coal 1½" dk.gy.→carb.sh 8½" coal 1½" carb.sh. 2" coal 1" dk.gy.sh 4½" coal 3½" dk.gy.sh 1" gy.sh.
2'0" coal
gy.sh.
Not sampled
5'5½"
gy.sh. 2" coal & inf. coal 2" gy.sh. 6" coal 1" gy.sh 10" coal 1'1" dk.gy.→carb.sh. 2" carb.sh ½" fwn.sh 2'0" coal with ¼" carb. sh at 7" & 1'4" gy.sh

FIG. 9

MT. ELLIOTT MINE AREA—DETAILED SEAM SECTIONS
MOOREFIELD No.3 BOTTOM SEAM

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.196	Description
M.%	3.9				
V.M.%	40.8				
F.C.%	38.1				
A.%	17.2	100	245/61	365'11½"	l.gy.sh. ¾" dk.gy.sh 6½"(b.c)coal 3"carb.sh. 3"coal 1¾"carb.sh 1"(b.c)coal 2¾" f.wn.sh. ¾"carb.sh ½"dk.gy.sh ¼"carb.sh. 2'6½"(p.b.c)coal
S.%	0.62		Excl.		
B.T.U./lb.	11550			370'1¼"	int.bd.carb.sh. & l.gy.sh.
S.G.	1.37				

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.197	Description
M.%	4.7				
V.M.%	36.9				
F.C.%	38.5				
A.%	19.9	97.0	246/61	183'2"	l.gy.sh.→gy.wh.f.ss 2¾" coal & inf. coal ¾" carb. sh. ½" f.wn.sh. 5½"(p.b.c)coal ¼"carb.sh. 3" l.gy.sh. 2½" f.wn.sh 1"coal ¼" l.f.wn.sh
S.%	0.57		Excl.		
B.T.U./lb.	10810				1'5"(p.b.c.)coal
S.G.	1.39				1"carb.sh. 5"(p.b.c.)coal ¾"carb.sh. 2" coal ¾"carb. sh. 7½"(p.b.c)coal
				187'6"	4½" f.wn.sh. 2¾"coal 6½" boulder ¾"carb.sh. ¼" dk.gy.sh. ¼" coal l.gy.sh→s.l.s.

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.200	Description
M.%	4.2				
V.M.%	38.1				
F.C.%	33.9				
A.%	23.8	88.0	247/61	247'11"	5¼"carb.sh. 1¼"(p.b.c)coal 2½"(b.c)gy.wh.sh ½"carb.sh 3½"(b.c)coal ½"carb.sh ½"med.gy.sh. 11"(p.b.c)coal
S.%	0.51		Excl.		
B.T.U./lb.	10310				1"carb.sh. 2½"(p.b.c)coal & inf. coal 2¾"f.wn.sh 1"coal ¾" f.wn.sh. 2"coal & inf. coal
S.G.	1.42				11"(p.b.c)coal, inf. in btm. 4" 1¼"carb.sh ½"coal ¼"dk.gy.sh. 7½"(b.c)coal
				252'2¼"	3¼" inf. coal 3½"carb.sh. gy. wh.sh.

N.S.209

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.209	Description
M.%	4.4				
V.M.%	40.3				
F.C.%	35.7				
A.%	19.6	93.0	248/61	260'10¾"	gy.wh.f.ss. 3½"carb.sh. 6¼"coal 1"carb.sh. 4¼" l.f.wn.sh ¼"carb.sh. 1"coal ¼"carb.sh. ½" f.wn.sh.
S.%	0.58		Excl.		
B.T.U./lb.	10820				2'8¼"(p.b.c)coal with 1½" inf. coal at 4" & 1"coal y.sh. at 1'11"
S.G.	1.39			265'1"	½" f.wn.sh ½"(b.c)coal ¼"carb.sh. 1"coal ½"carb. sh 2" f.wn.sh ¼"carb.sh. 6½" (p.b.c)coal ¼"carb.sh 1¼"med gy.sh. 1" f.wn.sh. 1"(b.c)coal ¼"carb.sh. l.gy.slts.

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.211	Description
M.%	5.1				
V.M.%	39.3				
F.C.%	36.5				
A.%	19.1	100	249/61	232'7"	gy.wh.f.ss. ¼"coaly sh 1"carb.sh. 9¼"(p.b.c)coal ¾"carb.sh. 4¼" l.gy.–l.f.wn.sh. ¾"coal 1"brn.sh
S.%	0.60		Excl.		
B.T.U./lb.	10800				1'6¼"(p.b.c)coal
S.G.	1.40				2"carb.sh.
				236'4"	7"(b.c)coal ½" f.wn.sh. ½" dk.gy.sh. 1"coal ½"carb.sh 1½" l.f.wn.sh ½" carb.sh 4½"(p.b.c)coal 1"l.gy –f.wn.sh 2¼" inf. coal 3"carb.sh.

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.212	Description
M.%	5.2				
V.M.%	38.6				
F.C.%	35.8				
A.%	19.4	100	250/61	260'6½"	¼" f.wn.sh 1"(b.c)coal ¼" br.sh
S.%	0.50		Excl.		
B.T.U./lb.	10740				1'0½"(p.b.c)coal 1"gy.wh.sh.
S.G.	1.40				2'0¼"(p.b.c)coal
				271'10¾"	½"(b.c)carb.sh. 2½" l.f.wn.sh 1"coal 2¼" l.f.wn.sh.

N.S.213

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.213	Description
M.%	4.3				
V.M.%	41.9				
F.C.%	33.2				
A.%	20.6	97.9	251/61	267'2"	5½" mod→dk.gy.sh ½" carb.sh. 6"(p.b.c)coal, inf. in btm. ¾" 4¾" carb.sh ½" f.wn.sh. 2¼" gy. wh.sh 1"carb.sh. 1¼" f.wn.sh.
S.%	0.51		Excl.		
B.T.U./lb.	10800				2'8"(p.b.c)coal, inf. in top 2" & from 8½"–11" & with ½" dk.gy.sh at 1'10"
S.G.	1.40			271'2¾"	5½" f.wn.sh. with ¾" coal at 2½" ½" carb.sh. 2" coal 1¼" carb.sh ¼" dk.gy.sh. ½" coal l.gy.sh.

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.214	Description
M.%	4.4				
V.M.%	41.0				
F.C.%	35.2				
A.%	19.4	100	252/61	235'8¾"	med.gy.sh. 5¼"carb.sh. 3½"(p.b.c)coal 1½"carb.sh. 4½" f.wn.sh.
S.%	0.53		Excl.		
B.T.U./lb.	11020				2'4½"(p.b.c)coal→inf. coal in btm. 4½"
S.G.	1.39			238'10¾"	2½" l.f.wn.sh. ½" f.wn.sh. ½" coaly sh. ¾"(b.c)coal l.gy.sh.

Prox. Analysis A, Cal. Val. & S.G.		Recovery per cent	Section Sampled	N.S.216	Description
M.%	5.8				
V.M.%	40.8				
F.C.%	34.1				
A.%	19.3	100	253/61	247'4½"	l.gy.sh. ½" carb.sh. 3¾" coal 5" inf. coal→coaly sh.→carb.sh. 4¾" coal
S.%	0.52		Excl.		
B.T.U./lb.	10730				5¼" l.f.wn.sh. ¼" carb.sh.
S.G.	1.38				3'7¼"(p.b.c)coal with ½" brn.sh at 1", ¼" carb.sh at 5", & 1'4½" & ½" gy–f.wn.sh at 2'10¾"
				251'11"	1"(p.b.c)carb.sh. ½" f.wn.sh. ½" (b.c)coal 1½" carb.sh 1¼"(b.c) coal 2½" l.f.wn.sh 1¾" inf. coal →coal 2" carb.sh. 1" med.gy.sh l.gy.sh. & slts.

MT. ELLIOTT MINE AREA—DETAILED SEAM SECTIONS
MOOREFIELD No.3 BOTTOM SEAM

Prox. Analysis S, Cal. Val. & S.G.	Recovery per cent	Section Sampled	N.S.218	Description
M.% 5·4 V.M.% 40·5 F.C.% 39·4 A.% 14·7 S.% 0·54 B.T.U./lb. 11500 S.G. 1·35	98·3	Excl. 254/61		234'6¼" dk.gy. wh.f.ss. 5½" (p.b.c.) coal 6¾" l.f.wn.sh. with ¾" coal at 5½" 2'8" (p.b.c.) coal 238'3¾" ½" l.gy.sh. ¼" coal 5" l.f.wn.sh 2¾" (p.b.c.) coal ½" med.gy.sh. ¾" coal l.gy.sh
			N.S.221	
M.% 6·7 V.M.% 39·2 F.C.% 37·3 A.% 16·8 S.% 0·45 B.T.U./lb. 11160 S.G. 1·37	86·6	Excl. 562/61		207'11" gy.sh 8" (b.c.) coal 1¾" (b.c.) carb.sh 3" (b.c.) inf. coal 3¼" f.wn.sh. 2'11½" (b.c.) coal 212'10½" 1¾" f.wn.sh. 4" (b.c.) carb.sh., ¾" f.wn.sh. in mid. 4" (b.c.) coal 1½" (p.b.c.) dk.gy.sh. 1" (p.b.c.) coal 1" carb.sh. l.gy.sh.→s/lts.
			N.S.222	
M.% 6·3 V.M.% 38·5 F.C.% 36·8 A.% 17·4 S.% 0·49 B.T.U./lb. 11020 S.G. 1·37	95·9	Excl. 255/61		281'6½" l.gy.silts→sh ½" coaly sh 3½" (p.b.c.) coal 2" carb.→dk.gy.sh. in middle 1" inf. coal 1¼" coaly sh. ¼" (b.c.) coal 1½" carb.sh. 1" f.wn.sh. ¼" carb.sh. ½" (b.c.) coal ¾" carb sh 2'5¼" (p.b.c.) coal with 1" carb.sh at 10", ¼" coaly sh at 1'3½", ½" carb.sh at 2'2¼", & ½" coaly sh at 2'4" ¼" carb.sh
M.% 6·2 V.M.% 40·0 F.C.% 37·2 A.% 16·6 S.% 0·63 B.T.U./lb. 11170 S.G. 1·37	96·2	Excl. 563/61		154'0" gy.wh.f.ss. 2¾" coal 4" (p.b.c.) carb.sh. 5¼" coal 3¾" f.wn.sh. 1¾" (b.c.) carb.sh. 1" f.wn.sh. 1½" (p.b.c.) inf. coal 2'3½" (b.c.) coal, inf. in places 159'1½" 1¾" f.wn.sh. ¼" (b.c.) carb.sh 2" f.wn.sh. ¾" (b.c.) carb.sh. 1½" (b.c.) coal dk.gy.-gy.sh.
			N.S.223	
M.% 6·9 V.M.% 37·9 F.C.% 38·5 A.% 16·7 S.% 0·48 B.T.U./lb. 11120 S.G. 1·37	100	Excl. 561/61		258'3½" med.gy.sh. 5" (b.c.) coal 4½" (p.b.c.) carb.sh 4½" (p.b.c.) coal, 1" inf. coal at ¾" 2" carb.sh. ¾" brn.sh 3¾" f.wn. sh. 1¼" carb.sh. ¼" f.wn.sh. 2'10½" (p.b.c.) coal with 1" carb.sh at 1'1¼" 263'5¼" ½" carb.sh. 1" f.wn.sh. 1" carb.sh. 1" f.wn.sh. 3¼" (p.b.c.) coal 3½" carb.sh. dk.gy.sh
			N.S.224	
M.% 5·8 V.M.% 39·4 F.C.% 33·3 A.% 21·5 S.% 0·47 B.T.U./lb. 10690 S.G. 1·41	90·5	Excl. 565/61		215'6¼" gy.sh. 3¾" dk.gy.sh. 9" (p.b.c.) coal ¾" (p.b.c.) carb.sh. 1" (p.b.c.) f.wn. sh. ¾" (b.c.) carb.sh. 1¼" f.wn.sh. 1½" coal ½" f.wn.sh. 1'0" (p.b.c.) coal→inf. coal ¾" carb.sh. 1'7" (b.c.) coal with ¾" carb.sh. at 2" & 10" 219'10¾" 1½" carb.sh. 1¼" (p.b.c.) f.wn.sh 220'1½" 3½" (b.c.) coal 2" (b.c.) dk.gy.sh.
M.% 7·5 V.M.% 35·5 F.C.% 36·7 A.% 20·3 S.% 0·51 B.T.U./lb. 10580 S.G. 1·41	100	Excl. 566/61		22'1'2" 7" (b.c.) coal gy.sh.
			N.S.225	
M.% 5·6 V.M.% 39·5 F.C.% 35·4 A.% 19·5 S.% 0·66 B.T.U./lb. 11060 S.G. 1·39	89·3	Excl. 567/61 Excl 568/61		232'5½" gy. wh.f.ss. ½" carb.sh. 8¾" (p.b.c.) coal ½" f.wn.sh. 1" carb.sh. 3" f.wn.sh. 1¼" carb.sh. ¾" f.wn.sh. ½" carb. sh. 1'8½" (p.b.c.) coal with ¾" sh at 1¼" 1¼" carb.sh. 8½" (p.b.c.) coal 236'4¾" ½" carb.sh. ½" f.wn.sh. 1" coal 236'8¾" 1½" carb.sh. ½" f.wn.sh. 237'4½" 7" (b.c.) coal 2" carb.sh. ½" (b.c.) f.wn.sh. l.gy.s/ts.
			N.S.226	
M.% 6·6 V.M.% 39·8 F.C.% 37·0 A.% 16·6 S.% 0·51 B.T.U./lb. 11320 S.G. 1·35	100	Excl. 581/61		240'1" gy. wh.f.ss. 2½" carb.sh. 6½" (p.b.c.) coal with ¼" sh at 4" ½" f.wn.sh. 1½" dk.gy.sh. 3" f.wn.sh. ¾" carb.sh. ¾" f.wn.sh. 2¾" (b.c.) coal with ¼" carb.sh. at 1¼" 1½" carb.sh. 7¼" (p.b.c.) coal ½" (b.c.) f.wn.sh. 1¼" carb.sh 1'10" (b.c.) coal 244'1¾" ½" carb.sh. 1¼" f.wn.sh. 1¼" carb.sh. 1½" f.wn.sh ¾" carb.sh 4½" (b.c.) coal ½" (b.c.) carb.sh gy.sh.

the Rosewood Coalfield. There the seams are underlain at intervals ranging from 30 to 70 ft. by another workable seam 5-7 ft. thick—the Lowfield seam (Cameron, 1962). This **Lowfield seam** can be recognised also in the Mount Elliott mine area where it lies usually about 50 ft. below the Moorefield No. 3 Bottom seam, the intervening strata being predominantly sandstone with some shale and siltstone and a few thin coal seams. In the north-east of the mine area around boreholes N.S. 211 and N.S. 223-224, there are no sandstone beds in this part of the succession and the topmost of the thin coal seams lies immediately below the Moorefield No. 3 Bottom seam. In consequence, the interval between the two seams in this part of the mine area is only 10-15 ft.

A characteristic feature of the Lowfield seam is the occurrence of a waxy, fawn shale band about 6 in. thick from 1 to 2 ft. from the roof. The workable sections penetrated in this seam all lie just below this particular shale band; they range in thickness from 5 ft. 2¾ in. to 6 ft. 5 in. and include several shale bands totalling from 9½ to 20 in. (see fig. 11).

In borehole N.S. 197 coal seams were encountered for 160 ft. below the Lowfield seam but, with one exception, none of these seams was of workable thickness. The workable section penetrated lies approximately 20 ft. below the Lowfield seam and is just over 4 ft. thick with one 1 ft. 1 in. shale band 2 ft. from the roof. This seam was tested also in boreholes N.S. 196, N.S. 209, and N.S. 211 but without success.

Drilling was continued in borehole N.S. 197 to a depth of 500 ft. 9 in. For 69 ft. below the last seam encountered, that is, from 397 ft. 2 in. to 465 ft. 10¼ in., the strata consist of fine grained sandstone, shale and siltstone of similar lithology to that of the overlying beds but without coal seams. Below 465 ft. 10¼ in. thin beds of medium grained pebbly sandstone occur interbedded with the usual Walloon-type rocks. This bottom 35 ft. is correlated with the **Marburg Sandstone** which outcrops a little over 3 miles to the north-east.

STRUCTURAL GEOLOGY

The outstanding structural feature of the Mount Elliott mine area is a major, east-south-east trending fault which lies just to the north of boreholes N.S. 200-201 and N.S. 206. The occurrence of this fault, previously unsuspected, was proved by the diamond drilling programme. Like the almost parallel faults which occur some 25 chains further northwards, this fault is of the normal type with the downthrown side to the north. The displacement is of far greater magnitude however, being almost 100 ft. in the vicinity of boreholes N.S. 200-201 (see fig. 12).

Although the regional dip of the Walloon Coal Measures in the Mount Elliott mine area is 2-3 degrees in a general southerly direction, the Top and Bottom seam workings occupy the northern portion of a shallow syncline which pitches gently southwards. This local flexure has apparently resulted from the faulting previously discussed, the synclinal axis coinciding in the vicinity of the fault with the postion of maximum displacement.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings):—

(*a*) measured reserves—up to 12½ chains.
(*b*) indicated reserves—from 12½ to 20 chains.

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

As a result of the 1956 and the 1960-61 diamond drilling programmes in the Mount Elliott mine area measured reserves have been established in the following seams.

Top Working seam.—Measured reserves totalling 545,000 tons extend over an area of 90 acres embracing boreholes N.S. 60, N.S. 196, N.S. 198-201, and N.S. 203-208 (see fig. 3). The seam thickness ranges from 3 ft. 10 in. to 4 ft. 10½ in., the average thickness of coal being 3 ft. 7½ in. The weighted average ash content is 16·7 per cent.

Bottom Working seam.—In an area of 47½ acres around boreholes N.S. 60, N.S. 63, N.S. 68, and N.S. 212-213, measured reserves with a weighted average ash content of 16·7 per cent. total 265,000 tons. Seam thickness ranges from 3 ft. 11½ in. to 4 ft. 10½ in., the average thickness of coal being 3 ft. 4 in.

Moorefield No. 3 Bottom seam.—Measured reserves totalling 1,080,000 tons and with a weighted average ash content of 18·3 per cent. extend over an area of 185 acres embracing boreholes N.S. 197, N.S. 209, N.S. 211-214, N.S. 216, and N.S. 218-226.

FIG 11

MT. ELLIOTT MINE AREA – DETAILED SEAM SECTIONS
LOWFIELD SEAM

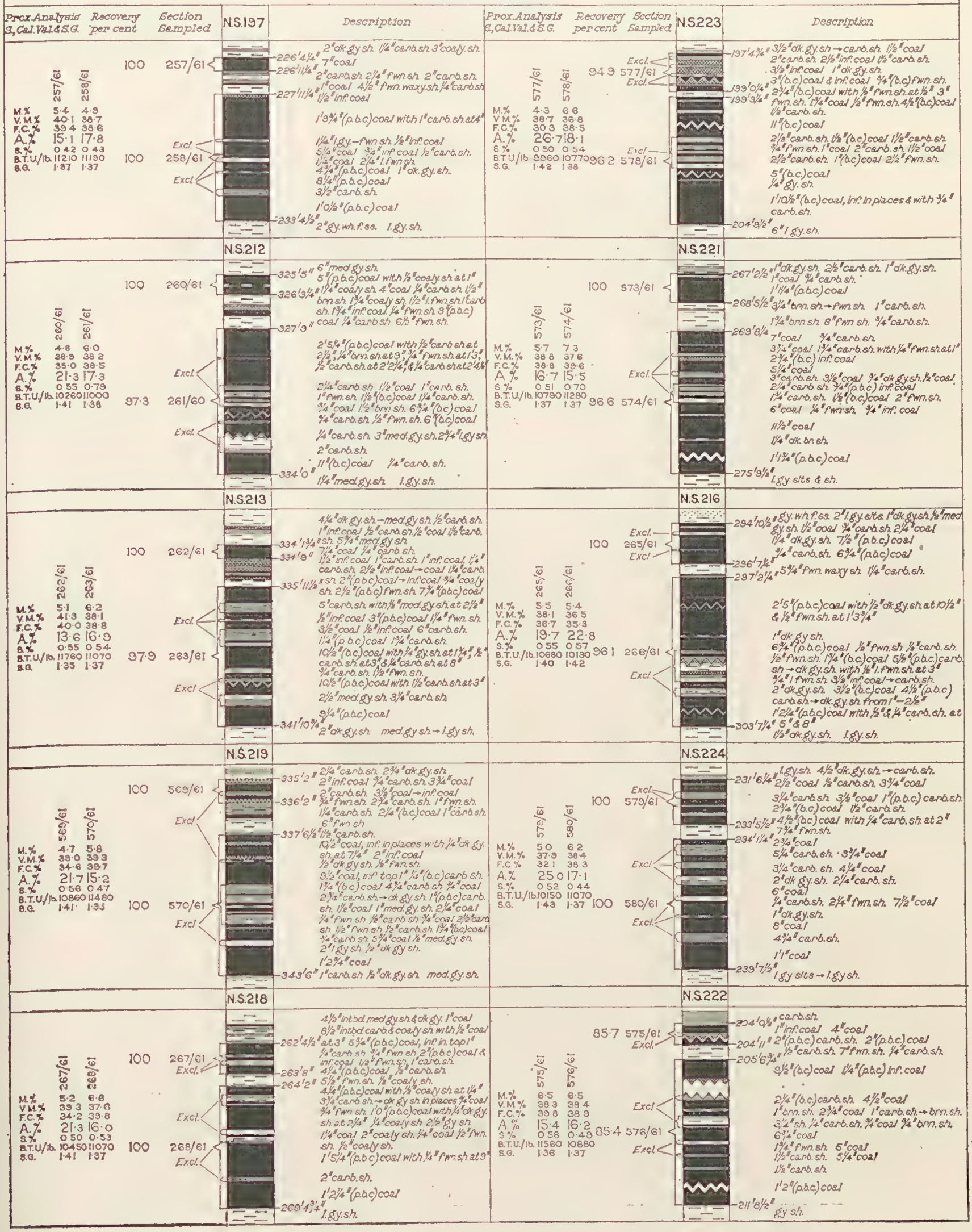
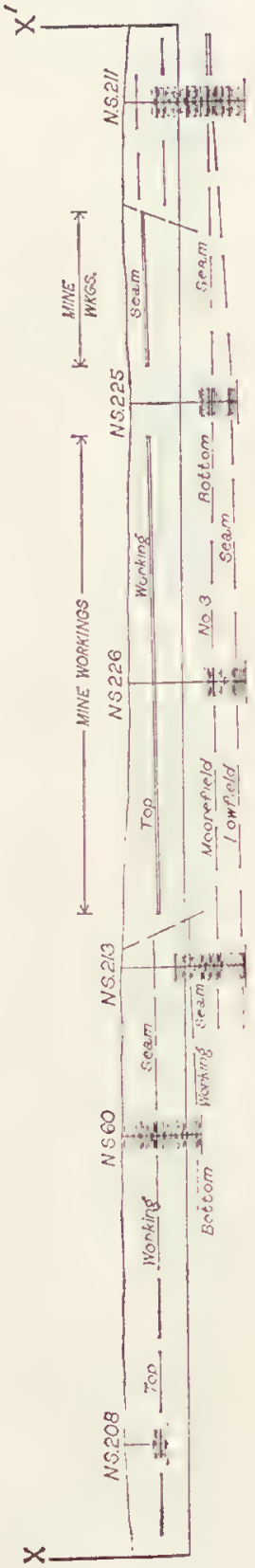
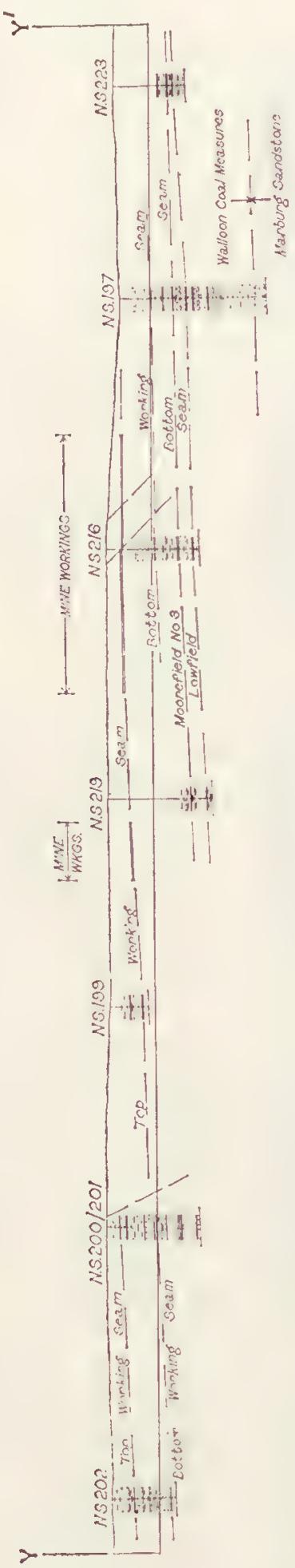

Prox. Analysis S, Cal. Val. & S.G.
Recovery per cent
Section Sampled
Description
N.S.197
257/61
258/61
M.% 5·4 4·9
V.M.% 40·1 38·7
F.C.% 39·4 38·6
A.% 15·1 17·8
S.% 0·42 0·43
B.T.U./lb. 11210 11190
S.G. 1·37 1·37
100 257/61
Excl.
100 258/61
Excl.
226'4¼" 2" dk. gy. sh. 1¼" carb. sh. 3" coaly. sh.
226'11¼" 7" coal
227'11¼" 2" carb. sh. 2¼" f'wn. sh. 2" carb. sh. 1" coal 4½" f'wn. waxy sh. ¼" carb. sh. ½" inf. coal
1'9¾" (p.b.c) coal with 1" carb. sh. at 4" 1¼" l. gy. – f'wn. sh. ½" inf. coal 5¼" coal ¾" inf. coal ½" carb. sh. 1¼" coal 2¼" l. f'wn. sh. 4¾" (p.b.c) coal 1" dk. gy. sh. 8¼" (p.b.c) coal 3½" carb. sh. 1'0½" (p.b.c) coal
233'4½" 2" gy. wh. f. ss. l. gy. sh.
N.S.212
260/61
261/61
M.% 4·8 6·0
V.M.% 38·9 38·2
F.C.% 35·0 38·5
A.% 21·3 17·3
S.% 0·55 0·79
B.T.U./lb. 10260 11000
S.G. 1·41 1·38
100 260/61
Excl.
97·3 261/60
Excl.
325'5" 6" med. gy. sh. 5" (p.b.c) coal with ½" coaly sh. at 1" 1¼" coaly sh. 4" coal ¼" carb. sh. 1½" brn. sh. 1¾" coaly sh. 1½" l. f'wn. sh. / carb. sh. 1¾" inf. coal ¼" f'wn. sh. 3" (p.b.c)
327'9" coal ¼" carb. sh. 6½" f'wn. sh. 2'5¼" (p.b.c) coal with ½" carb. sh. at 2½", ¼" brn. sh. at 9", ¾" f'wn. sh. at 1/3, ½" carb. sh. at 2'2¼", ¼" carb. sh. at 2'4½" 2¼" carb. sh. 1½" coal 1" carb. sh. 1" f'wn. sh. 1½" (b.c) coal 1¼" carb. sh. ¾" coal 1½" brn. sh. 6¾" (b.c) coal ¾" carb. sh. ½" f'wn. sh. 6" (b.c) coal ¼" carb. sh. 3" med. gy. sh. 2¾" l. gy. sh. 2" carb. sh.
334'0" 11" (b.c) coal ¼" carb. sh. 1¼" med. gy. sh. l. gy. sh.
N.S.213
262/61
263/61
M.% 5·1 6·2
V.M.% 41·3 38·1
F.C.% 40·0 38·8
A.% 13·6 16·9
S.% 0·55 0·54
B.T.U./lb. 11760 11070
S.G. 1·35 1·37
100 262/61
Excl.
97·9 263/61
Excl.
334'1¾" 4¼" dk. gy. sh. – med. gy. sh. ½" carb. sh. 1" inf. coal ½" carb. sh. ½" coal 1½" carb. sh.
334'8" 7¼" coal ¼" carb. sh. 1½" inf. coal 1" carb. sh. 1" inf. coal 1¼" carb. sh. 2½" inf. coal – coal 1¼" carb. sh. 2" (p.b.c) coal – inf. coal ¾" coaly sh. 2½" (p.b.c) f'wn. sh. 7¾" (p.b.c) coal
335'11½" 5" carb. sh. with ½" med. gy. sh. at 2½" ½" inf. coal 3" (p.b.c) coal 1¼" f'wn. sh. 3½" coal ½" inf. coal 6" carb. sh. 1¼" (p.b.c) coal 1¼" carb. sh. 10½" (b.c) coal with ¼" gy. sh. at 1¾", ½" carb. sh. at 3" & ¾" carb. sh. at 8" ¾" carb. sh. 1½" f'wn. sh. 10½" (p.b.c) coal with 1½" carb. sh. at 3" 2½" med. gy. sh. 3¼" carb. sh. 9¼" (p.b.c) coal
341'10¾" 2" dk. gy. sh. med. gy. sh. – l. gy. sh.
N.S.216
265/61
266/61
M.% 5·5 5·4
V.M.% 38·1 36·5
F.C.% 36·7 35·3
A.% 19·7 22·8
S.% 0·55 0·57
B.T.U./lb. 10680 10190
S.G. 1·40 1·42
100 265/61
Excl.
96·1 266/61
Excl.
294'10½" gy. wh. f. ss. 2" l. gy. sl/ts. 1" dk. gy. sh. ½" med. gy. sh. 1½" coal ¾" carb. sh. 2¼" coal 1¼" dk. gy. sh. 7⅛" (p.b.c) coal
296'7⅛" ¾" carb. sh. 6¾" (p.b.c) coal
297'2¼" 5¾" f'wn. waxy sh. 1¼" carb. sh. 2'5" (p.b.c) coal with ½" dk. gy. sh. at 10½" & ½" f'wn. sh. at 1'3¾" 1" dk. gy. sh. 6¾" (p.b.c) coal ½" f'wn. sh. 1¾" (b.c) coal 5½" (p.b.c) carb. sh. – dk. gy. sh. with ½" l. f'wn. sh. at 3" ¾" l. f'wn. sh. 3½" inf. coal – carb. sh. 2" dk. gy. sh. 3½" (b.c) coal 4½" (p.b.c) carb. sh. – dk. gy. sh. from 1" – 2½" 1'2¼" (p.b.c) coal with ½" & ¼" carb. sh. at
303'7¼" 5" & 8" ½" dk. gy. sh. l. gy. sh.
N.S.219
569/61
570/61
M.% 4·7 5·8
V.M.% 38·0 39·3
F.C.% 34·6 39·7
A.% 21·7 15·2
S.% 0·56 0·47
B.T.U./lb. 10860 11480
S.G. 1·41 1·35
100 569/61
Excl.
100 570/61
Excl.
335'2" 2¼" carb. sh. 2¾" dk. gy. sh. 2" inf. coal ¾" carb. sh. 3¾" coal
336'2" 2" carb. sh. 3½" coal – inf. coal ¾" f'wn. sh. 2¾" carb. sh. 1" f'wn. sh. 1¼" carb. sh. 2¼" (b.c) coal 1" carb. sh. 6" f'wn. sh
337'6½" 1½" carb. sh. 10½" coal, inf. in places with ¼" dk. gy. sh. at 7¼" 2" inf. coal ½" dk. gy. sh. ½" f'wn. sh. 9½" coal, inf. top 1" ¼" (b.c) carb. sh. 1¾" (b.c) coal 4¼" carb. sh. ¾" coal 2¾" carb. sh. – dk. gy. sh. 1" (p.b.c) carb. sh. 1½" coal 1" med. gy. sh. 2¼" coal ¼" f'wn. sh. ½" carb. sh. ¾" coal 2½" carb. sh. 1½" f'wn. sh. ½" carb. sh. 1¾" (b.c) coal ¾" carb. sh. 5¾" coal ½" med. gy. sh. 2" l. gy. sh. ½" dk. gy. sh. 1'2¾" coal
343'6" 1" carb. sh. ½" dk. gy. sh. med. gy. sh.
N.S.221
573/61
574/61
M.% 5·7 7·3
V.M.% 38·8 37·6
F.C.% 38·8 39·6
A.% 16·7 15·5
S.% 0·51 0·70
B.T.U./lb. 10790 11280
S.G. 1·37 1·37
100 573/61
Excl.
96·6 574/61
Excl.
267'2½" 1" dk. gy. sh. 2½" carb. sh. 1" dk. gy. sh. 1" coal ¾" carb. sh. 1'1¼" (p.b.c) coal
268'5½" 3¼" brn. sh. – f'wn. sh. 1" carb. sh. 1¾" brn. sh. 8" f'wn. sh. ¾" carb. sh.
269'8¼" 7" coal ¾" carb. sh. 3¼" coal 1¾" carb. sh. with ¼" f'wn. sh. at 1" 2¾" (b.c.) inf. coal 5¼" coal 3" carb. sh. 3½" coal ¾" dk. gy. sh. ½" coal 2¼" carb. sh. ¾" (p.b.c) inf. coal 1¾" carb. sh. ½" (b.c) coal 2" f'wn. sh. 6" coal ¼" f'wn. sh. ¾" inf. coal 11½" coal 1¼" dk. brn. sh. 1'1¾" (p.b.c) coal
275'3½" l. gy. sl/ts & sh.
N.S.222
575/61
576/61
M.% 6·5 6·5
V.M.% 38·3 38·4
F.C.% 39·8 38·9
A.% 15·4 16·2
S.% 0·58 0·48
B.T.U./lb. 11560 10880
S.G. 1·36 1·37
85·7 575/61
Excl.
85·4 576/61
Excl.
204'0⅛" carb. sh. 1" inf. coal 4" coal
204'11" 2" (p.b.c) carb. sh. 2" (p.b.c) coal
205'6¾" ½" carb. sh. 7" f'wn. sh. ¼" carb. sh. 9½" (b.c) coal 1¼" (p.b.c) inf. coal 2¼" (b.c) carb. sh. 4½" coal 1" brn. sh. 2¾" coal 1" carb. sh. – brn. sh. 3½" sh. ¼" carb. sh. ¾" coal ¾" brn. sh. 6¾" coal 1¾" f'wn. sh. 5" coal 1½" carb. sh. 5¼" coal 1½" carb. sh. 1'2" (p.b.c) coal
211'8½" gy. sh.
N.S.224
579/61
580/61
M.% 5·0 6·2
V.M.% 37·9 38·4
F.C.% 32·1 38·3
A.% 25·0 17·1
S.% 0·52 0·44
B.T.U./lb. 10150 11070
S.G. 1·43 1·37
100 579/61
Excl.
100 580/61
Excl.
231'6¼" l. gy. sh. 4½" dk. gy. sh. – carb. sh. 2½" coal ½" carb. sh. 3¾" coal 3¼" carb. sh. 3½" coal 1" (p.b.c) carb. sh. 2¾" (b.c) coal ½" carb. sh.
233'5½" 4½" (b.c) coal with ¼" carb. sh. at 2" 7¾" f'wn. sh.
234'1¼" 2¾" coal 5¼" carb. sh. 3¾" coal 3¼" carb. sh. 4¼" coal 2" dk. gy. sh. 2¼" carb. sh. 6" coal ¼" carb. sh. 2¼" f'wn. sh. 7½" coal 1" dk. gy. sh. 8" coal 4¾" carb. sh. 1'1" coal
239'7½" l. gy. sl/ts – l. gy. sh.
N.S.218
267/61
268/61
M.% 5·2 6·8
V.M.% 39·3 37·6
F.C.% 34·2 33·8
A.% 21·3 16·0
S.% 0·50 0·53
B.T.U./lb. 10450 11070
S.G. 1·41 1·37
100 267/61
Excl.
100 268/61
Excl.
262'4½" 4½" int. bd. med. gy. sh. & dk. gy. 1" coal 8½" int. bd. carb. & coaly sh. with ½" coal at 3" 5¾" (p.b.c) coal, inf. in top 1" ¼" carb. sh. ¾" f'wn. sh. 2" (p.b.c) coal & inf. coal 1/2" f'wn. sh. 1" carb. sh.
263'8" 4¼" (p.b.c) coal ½" carb. sh.
264'2" 5½" f'wn. sh. ½" coaly sh. 4¼" (p.b.c) coal with ½" coaly sh. at 1¼" 3¼" carb. sh. – dk. gy. sh. in places ¾" coal ¾" f'wn. sh. 1'0" (p.b.c) coal with ¼" dk. gy. sh. at 2¼" ¼" coaly sh. 2⅛" gy. sh. 1¼" coal 2" coaly sh. ¼" coal ½" f'wn. sh. ½" coaly sh. 1'5¼" (p.b.c) coal with ¼" f'wn. sh. at 9" 2" carb. sh. 1'2¼" (p.b.c) coal
269'4¾" l. gy. sh.

FIG. 12

MT. ELLIOTT MINE AREA
CROSS SECTIONS

Scale of Chains
10 8 6 4 2 0 2 4 6 8 10





LEGEND

Thin Limestone beds
Coal
Coal with shale bands
Shale with coal bands
Fault Breccia

Sandstone
Pebbly Sandstone
Shale
Siltstone
Iron carbonate

In assessing these reserves the lower of the two fawn shale bands in this seam has been taken as the pavement of the working section. Seam thickness as such ranges from 3 ft. 2 in. to 4 ft. 11½ in.; the average thickness of coal is 3 ft. 6 in. Workable coal was penetrated in this seam also in boreholes N.S. 196 and N.S. 200 to the south-west of the area defined but in view of the limited number of observation points no attempt has been made to estimate reserves thereabouts.

Lowfield seam.—The area of measured reserves which total 670,000 tons extends over 90 acres around boreholes N.S. 197, N.S. 212, N.S. 216, N.S. 218, and N.S. 220-223. The working section which lies immediately below the characteristic waxy fawn shale band ranges in thickness from 5 ft. 2¾ in. to 6 ft. 5 in., the average thickness of coal being 4 ft. 5¾ in. The weighted average ash content of the reserves is 17·6 per cent.

NATURE OF COAL

The coal from all four seams in which measured reserves have been established is of high volatile bituminous rank. Fixed carbon, calculated on a dry, mineral-matter-free basis, ranges from 44·50 to 56·61 per cent. Calorific value, calculated on a moist, mineral-matter-free basis ranges from 12,760 to 14,400 B.Th.U. per lb.

CONCLUSIONS

As a result of the exploratory diamond drilling carried out in the Mount Elliott mine area by the Department of Mines in 1956 and 1960-61 measured reserves have been established as follows:—

	Tons
Top Working seam	545,000
Bottom Working seam	265,000
Moorfield No. 3 Bottom seam ..	1,080,000
Lowfield seam	670,000
Total	2,560,000

At present only the upper two seams are being exploited, but the measured coal in the other two seams is so disposed that it can be readily worked from the present pithead of Mount Elliott No. 1 Extended Colliery. In that part of the mine area, the Moorefield No. 3 Bottom seam and the Lowfield seam lie 70 ft. and 105 ft. respectively below the Bottom Working seam.

REFERENCES

CAMERON, J. B., 1962: Coal resources—Rosewood-Walloon coalfield (United No. 8 mine area). *Qld Govt Min. J., 63,* 125-137.

————, 1963: Coal resources, Rosewood-Walloon coalfield (Mount Elliott mine area). *Geol. Surv. Qld Pub., 311,* 1-6.

27th July, 1961.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (MOOREFIELD No. 3 MINE AREA)

By J. B. CAMERON

SUMMARY

As part of a programme of emergency drilling in the Amberley district, two shallow holes were drilled to test extension of the previously worked Top seam which had been prospected recently by a shaft. Although the seam section exposed was under 3 ft. (usually regarded as the minimum workable), the management consider that by employing longwall methods, this reduced thickness can be worked profitably. On this basis, indicated reserves with an average thickness of 2 ft. 10 in. extend over an area of 38 acres and amount to 185,000 tons. Average ash content is 20.7 per cent.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

In August 1956, as part of the emergency programme of diamond drilling carried out by the Mines Department in the Amberley district of the Rosewood Coalfield, two holes, N.S. 69 and N.S. 72, were drilled by the Longyear No. 2 plant in the Moorefield No. 3 mine area. Aggregate footage was 292 ft. 4 in.

Although two seams have been worked in Moorefield No. 3 Colliery, only the Bottom seam has been exploited in recent years. As a result of general deterioration in this lower seam, a prospecting shaft was sunk by the colliery management early in 1956 to test the Top seam to the south of the existing workings. As the section exposed was not quite 3 ft. thick (see fig. 4), the Moorefield drilling was undertaken to determine the condition of the Top seam in that part of the mine area. At the same time, the opportunity was taken of testing the Bottom seam 20-30 ft. below.

This report is accompanied by the following plans, sections and diagrams:—

(*a*) Locality Plan—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and area within which reserves have been estimated; together with one cross-section—fig. 2.

(*c*) Generalised Bore Sections—fig. 3.

(*d*) Diagrams showing detailed sections of the Top and Bottom seams with analytical results—fig. 4.

MINE WORKINGS

Moorefield No. 3 Colliery is situated in the Amberley district, 2 miles south of Walloon Railway Station and 5 miles east of Rosewood. The workings lie within Coal Mining Lease No. 341, held by Samuel Gerrard Purnell and party.

Operations first commenced in this mine area in the early 1930's at Amberley No. 1 Colliery. In 1941, Amberley No. 2 Colliery was opened some 7 chains to the north-east. Although the Bottom seam was prospected, only the Top seam was worked in these two collieries. Abandoned in 1942, the No. 2 tunnel was re-opened in 1945 as Moorefield No. 3 Colliery. The Top seam was again worked for a few years but more recently all production has come from the Bottom seam.

Some 20 chains to the north-east of Moorefield No. 3 tunnel lies Coalfields Colliery; there the Top seam also is being exploited. Almost one mile to the south-east is situated Mount Elliott No. 1 Extended Colliery. The working seams there, however, lie stratigraphically about 100 ft. above the Moorefield seams.

Since the completion of the drilling programme, a new tunnel has been driven adjacent to the prospecting shaft to intersect the Top seam which, it is intended, will be worked by longwall methods.

GENERAL GEOLOGY

The general geology of the nearby Mount Elliott mine area has already been discussed briefly by Cameron (1963). The Top and Bottom seams at Moorefield undoubtedly underlie the Mount Elliott working seams, the interval between the two productive

FIG. 1
WALLOON RIVER
Parish of Walloon
BREMER
AMBERFIELD
C.M.L. 383
MINE AREA
MOOREFIELD
C.M.L. 413
MINE AREA
C.M.L. 341
Parish of Jeebropilly
MOUNT ELLIOTT
MINE AREA
C.M.L. 315 Appn.
C.M.L. 348
C.M.L. 470
Amberley Sch.
Warrill Ck.
27°37'S.
27°38'S.
27°39'S.
152°40'E.
152°41'E.
12000 N.
10000 N.
8000 N.
6000 N.
4000 N.
2000 N.
2000 S.
4000 S.
6000 S.
LOCALITY PLAN
AMBERLEY DISTRICT
COUNTY OF CHURCHILL
SCALE OF CHAINS
40 0 40 80

DEPARTMENT OF MINES, QUEENSLAND

FIG. 2

MOOREFIELD MINE AREA
WALLOON–ROSEWOOD COALFIELD

Showing topography, boreholes, mine workings and area within which reserves have been estimated

To accompany report by J.B.Cameron, B.Sc.App.(Geol)

Topographic survey by Ewan Cowley, Assistant Surveyor

SCALE OF CHAINS

4 0 4 8 12 16 20

SURVEY DATA

Grid of 20 chain co-ordinates. Meridian of Grid is True North at point of origin, peg A, bearing 350' and distant 16' from north-east corner of Por. 179, Parish of Jeebropilly. Elevations in feet on State Datum.

EXPLANATION

Diamond drillhole ..... ◎ N.S.71
Colliery ..... NEATH
Surface contour 70
Adit ..... Shaft .....
Section line ..... X——X'
Underground level .....
Mine workings on Top Seam .....
Mine workings on Bottom Seam .....
Calculated reserves Top Seam .....
Seam section measured ..... ⊗A

COALFIELDS

MOOREFIELD No.3

AMBERLEY No.1 A

New Airshaft

P.D.

N.S. 69
R.L.COLL. 168·45
R.L.SURF. 165·26
R.L.BTM. −22·05

N.S. 72
R.L.COLL. 131·15
R.L.SURF. 129·95
R.L.BTM. 19·32

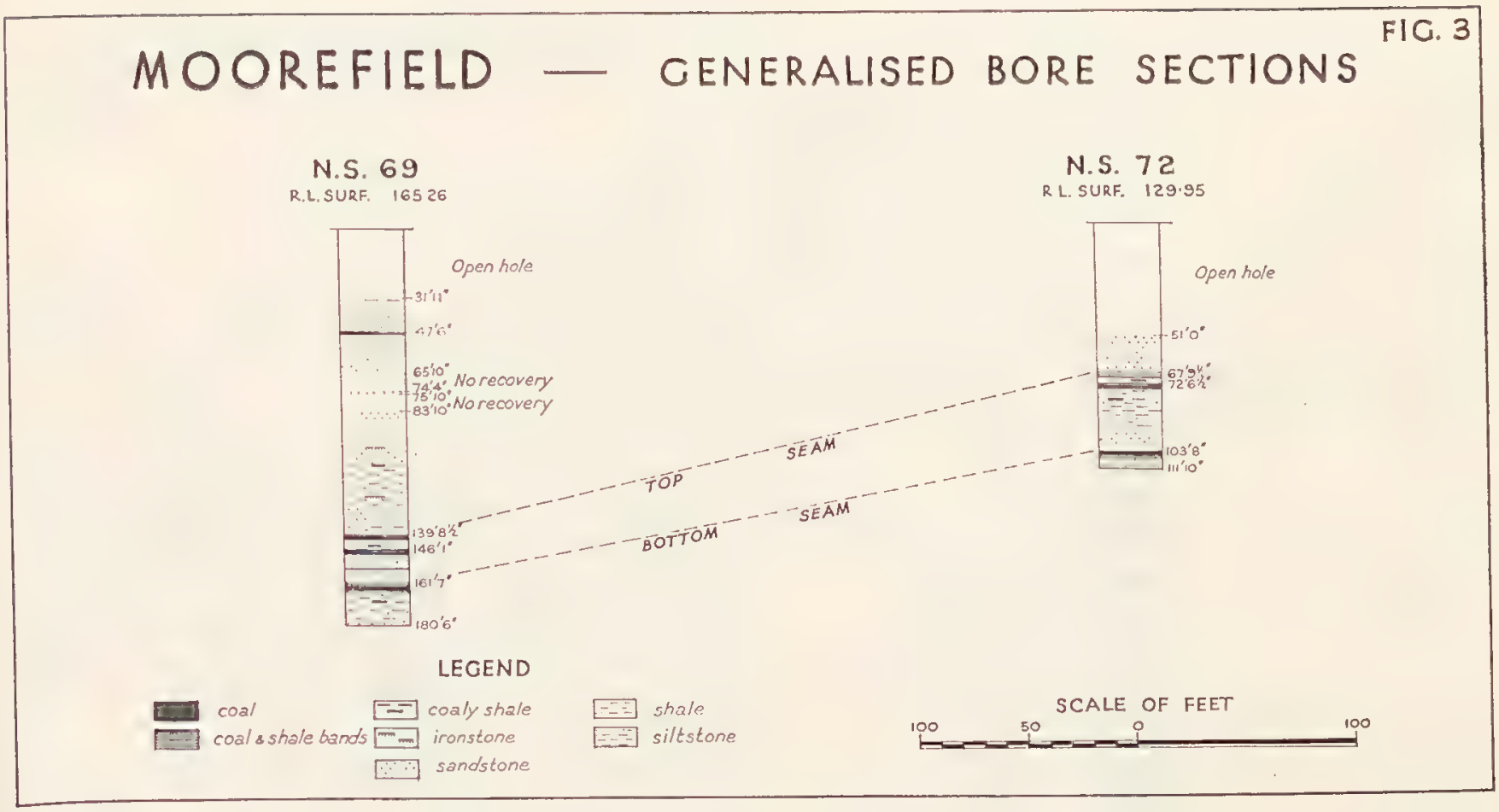
72 73 74 75 76 77 80 81 82 83 88 89

8000 W. 6000 W. 4000 W. 2000 W.

6000 N. 4000 N. 2000 N.

CROSS SECTION X–X'

FIG. 3



sequences being estimated at approximately 100 ft. The Moorefield No. 3 Top and Bottom seams can be equated on stratigraphic grounds with the United No. 8 Top and Bottom seams which are well developed in the Perry's Knob area of the Rosewood Coalfield (Cameron, 1962).

SUBSURFACE GEOLOGY

The highest coal seam in the Jurassic succession developed in the Moorefield area lies some 90 ft. above the Top seam, the intervening strata being predominantly sandstone with some shale and one thin coal ply. The seam is known only from borehole N.S. 69 where, at a depth of 47 ft. 6 in. it is approximately 1 ft. thick. This coal must lie very close to the horizon of the **Mt. Elliott Bottom seam** and could even be equivalent to it.

Within the area tested, the **Top seam** consists of two distinct sections of coal. The main part of the seam varies from 2 ft. 8 in to 2 ft. 11 in. thick and contains only a few very thin shale bands. Above this at intervals of 2½ to 4 ft., there is a section of interbedded coal and shale about 2 ft. thick (see fig. 4). Only the lower part of the seam presents a possibly workable section but nowhere does this reach a thickness of 3 ft.

In boreholes N.S. 69 and N.S. 72, the **Bottom seam** was penetrated 13 ft. and 28 ft. respectively below the Top seam, the strata between the two seams being sandstone and shale with one thin coal ply. Only in borehole N.S. 69 does the seam approach workability (see fig. 4).

Although no testing of the Walloon Coal Measures below the horizon of the Bottom seam has been carried out in the Moorefield No. 3 mine area, another 200-250 ft. of coal-bearing strata can be expected.

STRUCTURAL GEOLOGY

The regional dip of the Walloon Coal Measures in the Moorefield area is about 2 degrees to the south-east. As in other parts of the Rosewood Coalfield, however, local irregularities both in the angle and direction of dip do occur. No major faulting has yet been encountered in the mine area.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:— a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content after exclusion of stone bands normally removed in practice, of not more than 25 per cent. If these conditions were to apply in the Moorefield No. 3 mine area, there would be no reserves of workable coal. However, although in the area tested to the south of the mine workings, the Top seam reaches a maximum thickness of only 2 ft. 11 in., the colliery management consider that this restricted section can be worked profitably by longwall methods and have recently had a tunnel driven to the seam adjacent to the prospecting shaft which now serves as the new airshaft. In calculating reserves in the Moorefield area, therefore, a minimum workable seam thickness of 2 ft. 6 in. has been adopted.

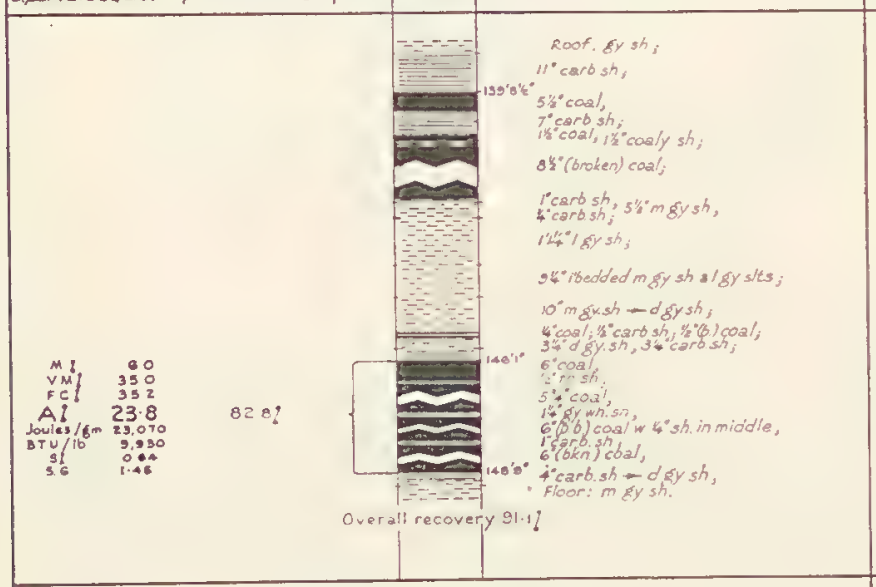
FIG.4

MOOREFIELD

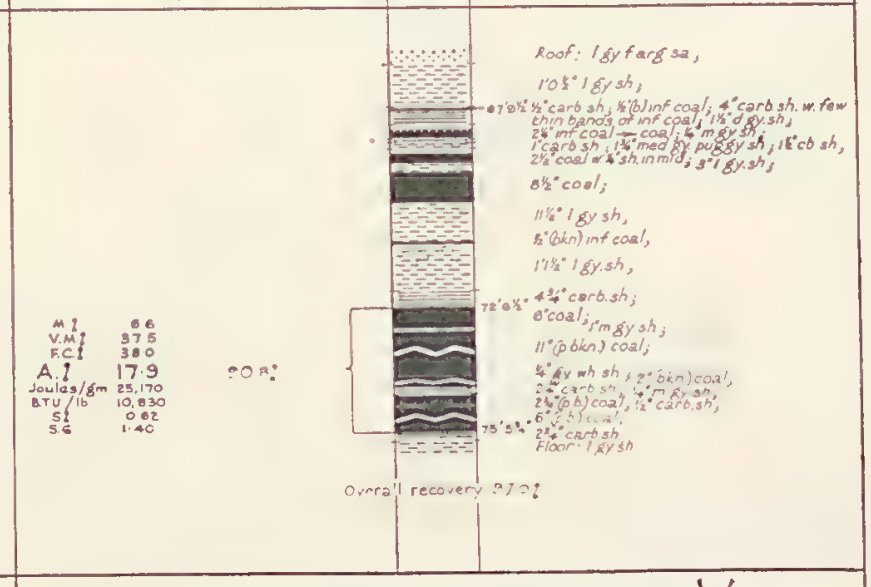
DIAGRAMS OF SEAMS — DETAILS OF CORE RECOVERY AND ANALYSIS

TOP SEAM

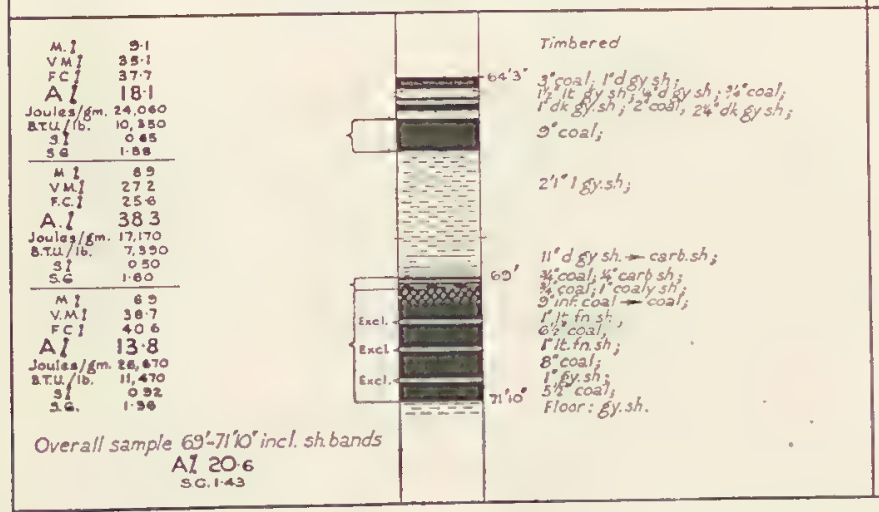
N.S. 69



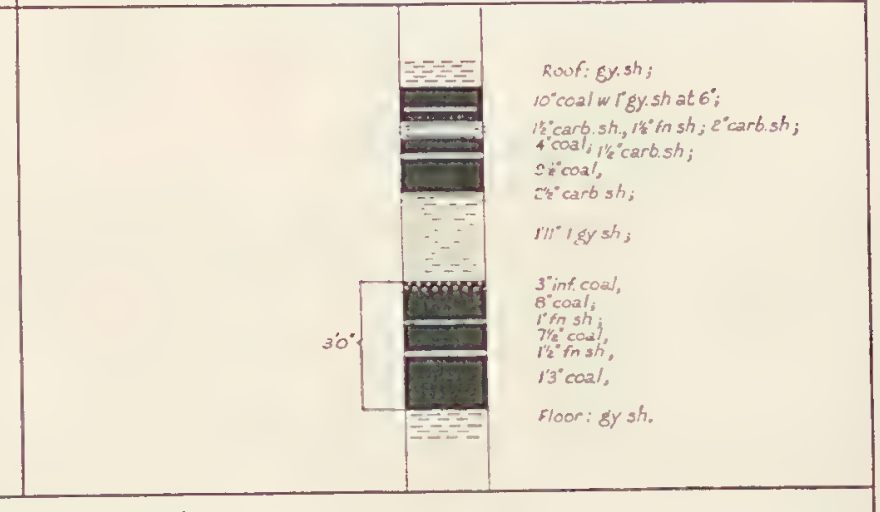
N.S. 72


Prox. Analysis S.Cal value & S.G
Recovery per cent
Section Sampled
Seam Section
Description
M.I 6·6
V.M.I 37·5
F.C.I 38·0
A.I 17·9
Joules/gm 25,170
BTU/lb 10,830
S.I 0·62
S.G 1·40
90 8/12%
67'8½"
72'8½"
75'5¼"
Roof: l gy f arg sa,
1'0½" l gy sh,
½" carb sh; ½" (b) inf coal; 4" carb sh w few thin bands of inf coal; 1½" d gy sh;
2¾" inf coal — coal; ¼" m gy sh;
1" carb sh; 1¾" med gy pug gy sh; 1⅛" cb sh,
2⅛" coal w ¼" sh in mid; 3" l gy sh;
8½" coal;
11¼" l gy sh,
½" (bkn) inf coal,
1'1½" l gy sh,
4¾" carb sh;
6" coal; f m gy sh;
11" (p bkn) coal;
¼" gy wh sh; 2" (bkn) coal,
2" carb sh; 2" m gy sh,
2¼" (p b) coal; ½" carb sh,
6½" (b) coal,
2" carb sh
Floor: l gy sh
Overall recovery 97·0%

NEW AIRSHAFT

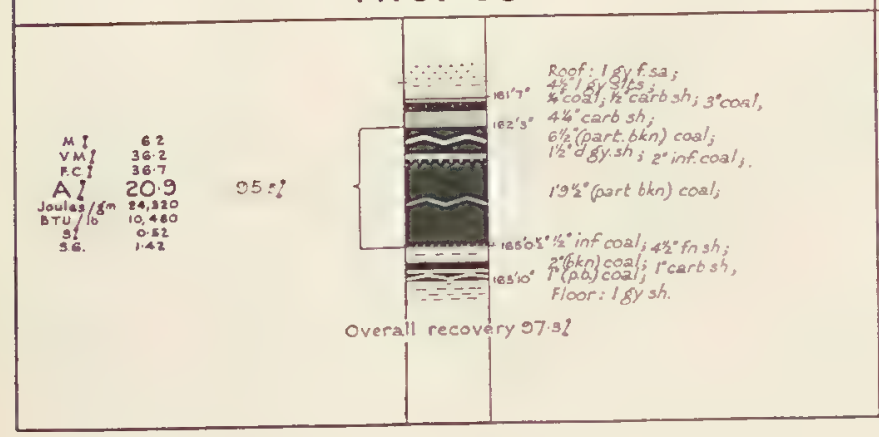


COALFIELDS COLLIERY 'A'

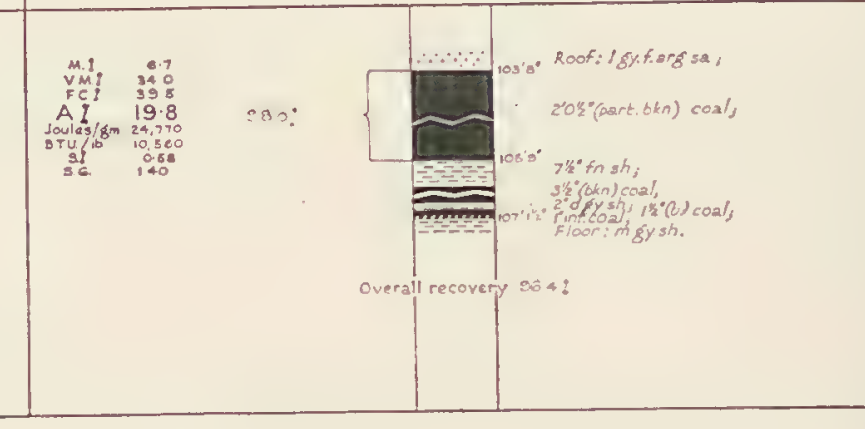


BOTTOM SEAM

N.S. 69



N.S. 72



The status of reserves established by the drilling programme depends on the distance between observation points (diamond drill holes, shafts or mine workings):—

(*a*) measured reserves—up to 12½ chains.

(*b*) indicated reserves—more than 12½ chains.

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of these points of observation at which the seam section satisfies the three requirements of workability.

Only indicated reserves were established by the drilling programme in the Moorefield area. These reserves totalling 185,000 tons and with a weighted average ash content of 20·7 per cent. lie in the **Top seam** over an area of 38 acres embracing boreholes N.S. 69 and N.S. 72 and the new airshaft and extending towards Coalfields Colliery. Average seam thickness is 2 ft. 10 in., including several thin shale bands which would not be removed in mining.

CONCLUSIONS

The emergency diamond drilling programme in the Moorefield No. 3 mine area during 1956 showed that the Top seam to the south of the existing workings varies in thickness from 2 ft. 8 in to 2 ft. 11 in. Despite this restricted section, the colliery management consider that the seam can be profitably worked by longwall methods and have recently commenced development. In consequence, the minimum seam thickness of 3 ft. usually accepted as the limit of workability has been reduced to 2 ft. 6 in. in this mine area. Calculated on this basis, indicated reserves in the Top seam amount to 185,000 tons of coal with a weighted average ash content of 20·7 per cent.

REFERENCES

CAMERON, J. B., 1962: Coal resources—Rosewood-Walloon coalfield (United No. 8 mine area). *Qld Govt. Min. J., 63,* 125-137.

————, 1963: Coal resources, Rosewood-Walloon coalfield (Mount Elliott mine area). *Geol. Surv. Qld Publ.,* 311, 1-6.

9th October, 1959.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (AMBERFIELD MINE AREA)

By J. B. CAMERON

SUMMARY

This report sets out the information gained from the drilling of three shallow boreholes. Although limited, it was sufficient to show that, because of pre-Tertiary erosion to the north-east and seam deterioration and faulting to the west, development of the working seam could be extended only to the south-east. In this area, reserves, with average ash content of 25.4 per cent., extend over an area of some 16 acres and amount to 105,000 tons.

Access to these reserves, however, is no longer available and development has been transferred recently to a lower seam where, on information available, only a small area of workable coal can be expected.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

The emergency programme of diamond drilling carried out by the Mines Department in the Amberley district of the Rosewood Coalfield was completed in September, 1956, when two shallow holes, N.S. 74-75, were drilled by the Longyear No. 2 plant in the Amberfield mine area. While both these holes were designed to test the quality of the Working seam, borehole N.S. 75 was specially sited to provide information about the faulting which had stopped development in the western part of the colliery.

Earlier, in January and February, 1952, another diamond drill hole, N.S. 1, was put down by the Mines Department in the Amberfield area. This hole was drilled by the Sullivan 22 H.D. plant to determine the nature and extent of a washout which had been encountered in the north-eastern part of the workings.

The information gained from these three Departmental boreholes is summarised in this report which is accompanied by the following plans and diagrams:—

(*a*) Locality Plan—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and area within which reserves have been estimated; together with one cross-section—fig. 2.

(*c*) Generalised bore sections—fig. 3.

(*d*) Diagrams showing detailed sections of the Top and Working seams with analytical results—fig. 4.

MINE WORKINGS

Amberfield Colliery is situated 1½ miles south-east of Walloon Railway Station and approximately 6 miles to the east of Rosewood. The workings lie within Coal Mining Lease No. 383 and C.M.L. (Application) No. 413 held in the name of Noel Horace Roots.

Operations commenced in this mine area in 1948. For many years, only the Working seam was exploited but in 1958 a cross-measure drift was driven to an underlying seam which is now being developed for longwall mining.

GEOLOGY

The full extent of pre-Tertiary erosion in the Amberfield area was not realised until 1952 when nearly 120 ft. of **Tertiary** sediments and overlying basalt were encountered above the Walloon Coal Measures in N.S. 1. This hole, drilled after all the north-easterly working places had encountered weathered coal beneath no less than 80 ft. of cover, showed that, 5 chains beyond, the working seam was completely washed out, the base of the Tertiary sediments occurring some 30 ft. below the expected depth of the seam. To the south and west of N.S. 1, however, the Tertiary cover thins rapidly and is completely absent over most of this part of the mine area.

The highest coal seam in the Jurassic succession developed in the Amberfield area is that encountered in borehole N.S. 74 at a depth of 76 ft. This **Top seam** which is overlain by at least 55 ft. of interbedded sandstone and shale with several thin coal plies is 4 ft. 10½ in. thick but contains several shale bands totalling 1 ft. 9 in. (see fig. 4). In borehole N.S. 74, another seam, 4 ft. thick, with several thin bands of fawn shale lies only 4 ft. below. These two seams have not been recognised with certainty elsewhere in the mine area; the 2½ ft. of coal met 5 ft. above the working seam in the prospecting rise driven from Amberfield Colliery workings may be equivalent to the lower seam.

Although washed out in borehole N.S. 1, the **Working seam** was cored in N.S. 74 beneath at least 80 ft. of Jurassic cover. The working section there is 5 ft. 7 in. thick and contains several shale bands totalling 2 ft. (see fig. 4). This is considerably less than the usual seam thickness in the mine workings of 7 ft., the reduced section being due to deterioration of the bottom 18 in. of coal to carbonaceous shale. In borehole N.S. 75, the unworkable 7 ft. 5 in. section of coal and shale bands at 66 ft. 4½ in. is tentatively correlated with the Working seam.

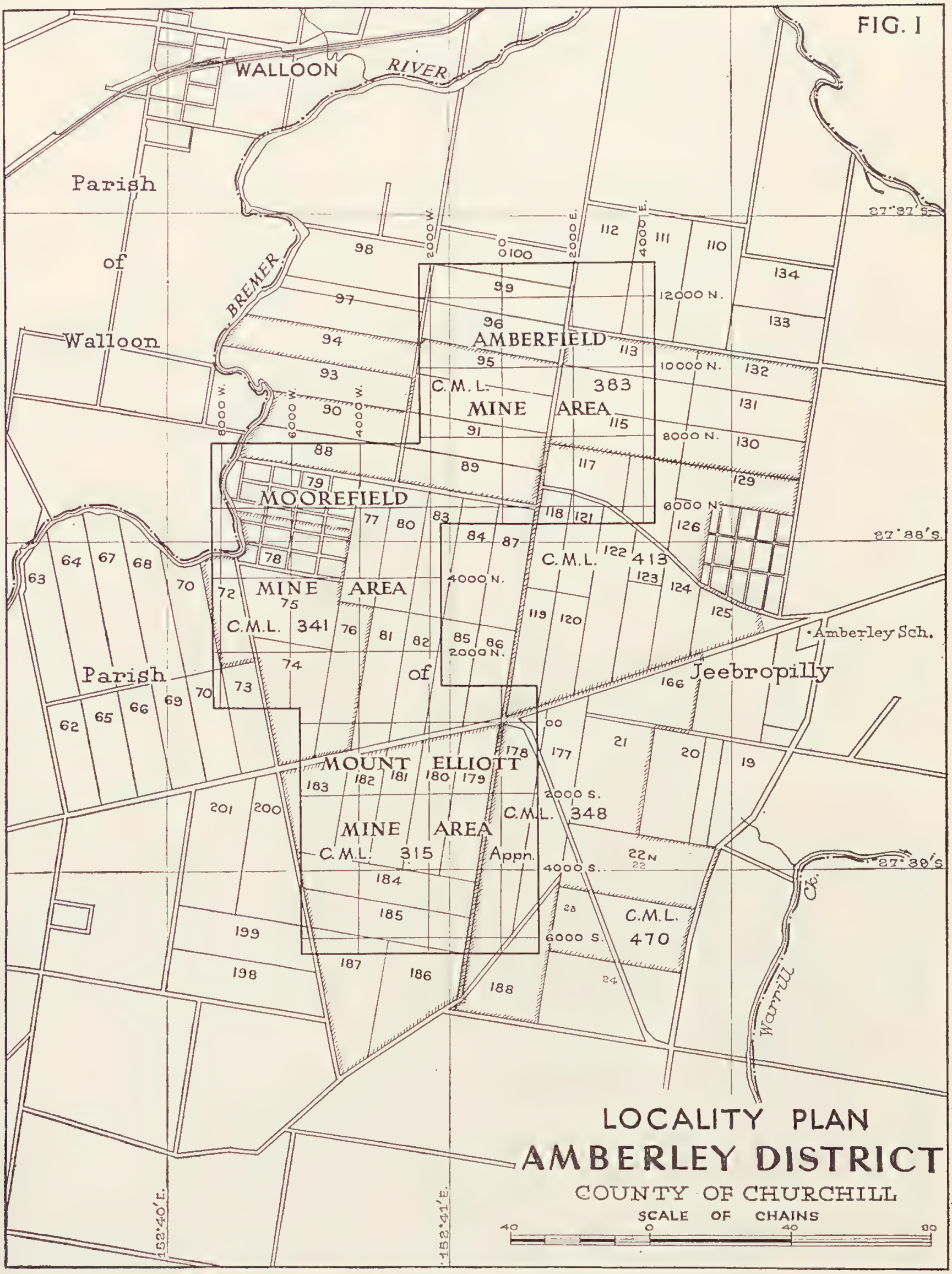


FIG. 1
WALLOON RIVER
Parish of Walloon
BREMER
AMBERFIELD
C.M.L. 383
MINE AREA
MOOREFIELD
C.M.L. 413
MINE AREA
C.M.L. 341
Parish of Jeebropilly
MOUNT ELLIOTT
MINE AREA
C.M.L. 315 Appn.
C.M.L. 348
C.M.L. 470
Amberley Sch.
Warrill Ck.
27°37'S.
27°38'S.
27°39'S.
152°40'E.
152°41'E.
2000 W.
2000 E.
4000 E.
12000 N.
10000 N.
8000 N.
6000 N.
4000 N.
2000 N.
2000 S.
4000 S.
6000 S.
LOCALITY PLAN
AMBERLEY DISTRICT
COUNTY OF CHURCHILL
SCALE OF CHAINS
40 0 40 80

DEPARTMENT OF MINES, QUEENSLAND

AMBERFIELD MINE AREA
WALLOON-ROSEWOOD COALFIELD

Showing topography, boreholes, mine workings and area within which reserves have been estimated.

To accompany report by J.B.Cameron, B.Sc.App.(Geol.)
Topographic survey by Ewan Cowley, Assistant Surveyor.

SCALE OF CHAINS

4 0 4 8 12 16 20

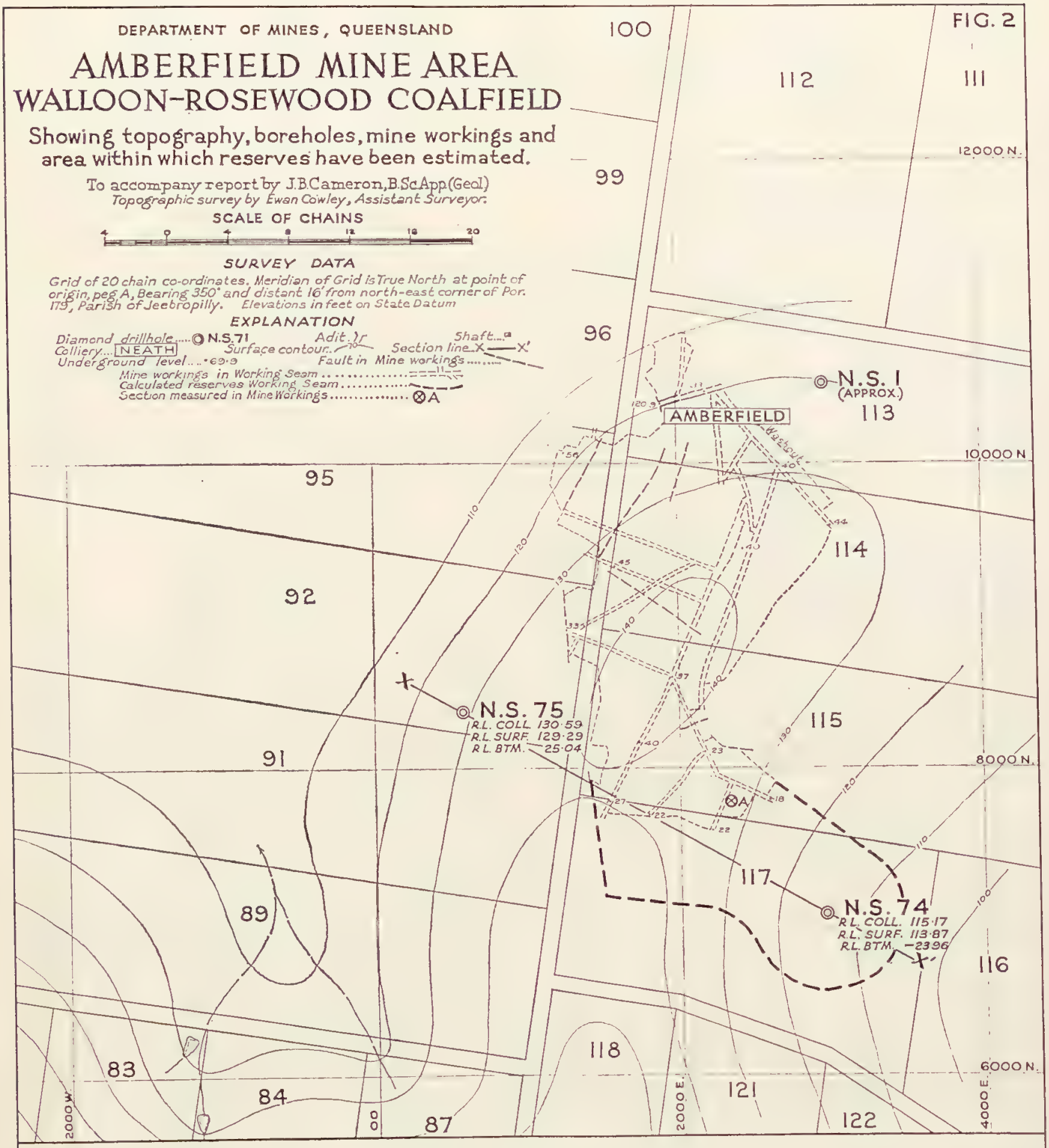
SURVEY DATA

Grid of 20 chain co-ordinates. Meridian of Grid is True North at point of origin, peg A, Bearing 350° and distant 16' from north-east corner of Por. 179, Parish of Jeebropilly. Elevations in feet on State Datum

EXPLANATION

Diamond drillhole N.S.71
Colliery .... NEATH
Underground level ..... 69·9
Adit
Surface contour
Fault in Mine workings .....
Shaft
Section line X — X'
Mine workings in Working Seam .....
Calculated reserves Working Seam .....
Section measured in Mine Workings ..... A

FIG. 2



CROSS SECTION X–X'

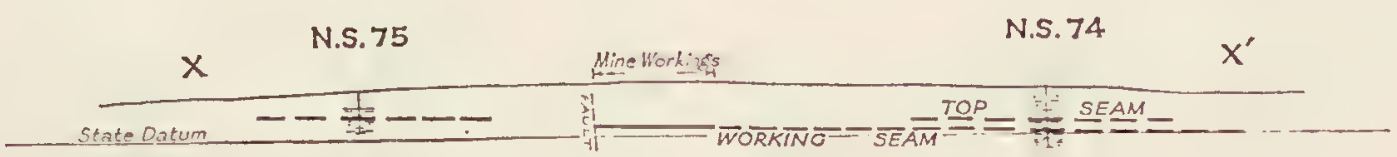
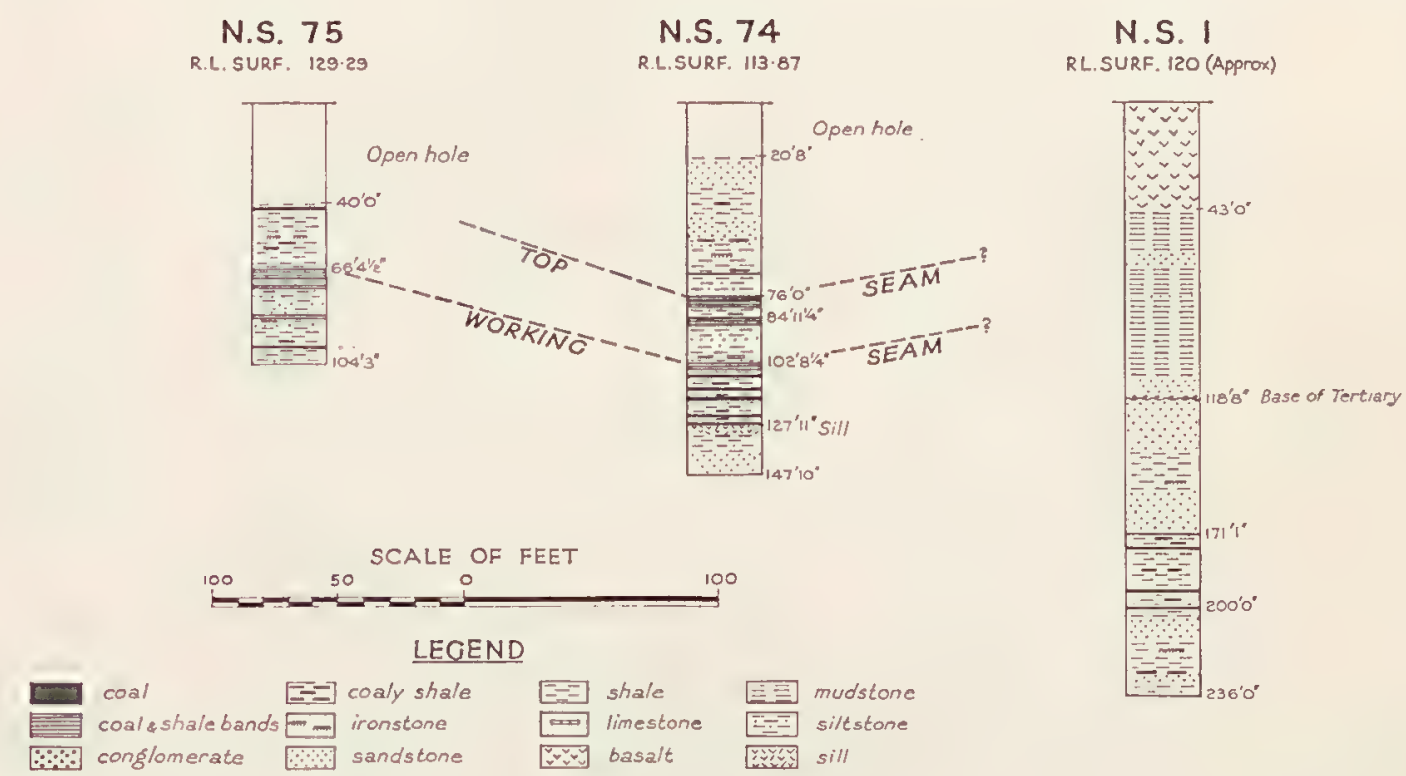


FIG. 3



In borehole N.S. 74, several thin coal seams were encountered for approximately 20 ft. below the Working seam. None of these seams, however, can be correlated with certainty with the lower seam now being developed at Amberfield Colliery. The lowest seam in this succession of interbedded coal and shale is intruded in N.S. 74 by a basaltic sill 3 ft. 9 in. thick, the coal above and below being coked for several inches beyond the contact. It is interesting to note that borehole N.S. 74 was the first diamond drill hole of the Department of Mines' exploratory programme on the Rosewood Coalfield to encounter igneous intrusion in the Walloon Coal Measures.

Only in borehole N.S. 1 was the drilling continued much below the horizon of the Working seam; there, almost another 120 ft. of Walloon Coal Measures were tested. Although several coal seams were penetrated between 170 ft. and 200 ft., none of these was more than 2 ft. thick.

STRUCTURAL GEOLOGY

Within the Amberfield mine area, the Walloon Coal Measures are practically horizontal, the regional dip being less than 2 degrees to the south-east. Local irregularities in the attitude of the beds, however, are quite common in the colliery workings, due mainly to the unusually large number of minor faults encountered. These faults have greatly hampered mining operations but only in the western workings has faulting completely stopped mine development. The fault there which has been met in two places some 10 chains apart trends almost north-south and has a suspected upthrow to the west. Because of the uncertain seam correlation in borehole N.S. 75, the displacement along the fault is not definitely known but information at present available suggests that it is not more than 20 ft.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. Of the seams cored during the Amberfield drilling programme, only the **Top seam** in borehole N.S. 74 fulfills these three requirements. In the absence of other points of observation, however, no reserves of workable coal were established in this seam.

In borehole N.S. 74, the **Working seam,** while not completely satisfying the three conditions of workability previously defined, is of similar quality to that already exploited in Amberfield Colliery. An estimate, therefore, has been made of the tonnage of this high-ash coal proved by the drilling programme. Reserves with an average ash content of 25·4 per cent. and extending over nearly 16 acres to the south-east of the mine workings are calculated at 105,000 tons.

FIG. 4

AMBERFIELD

DIAGRAMS OF SEAMS · DETAILS OF CORE RECOVERY AND ANALYSIS

TOP SEAM

N.S. 74

Ash & S.G.	Recovery per cent	Section Sampled	Seam Section	Description
Ash 24·4 S.G. 1·42	95·3%			Roof: 1 gy.f.arg.sa.; 1'0"(part) (bkn) coal; ¾"carb.sh; 1½"(bkn)coal; ¼"carb.sh; 1"(bkn)coal; 1"carb.sh; 1'4"(bkn) coal & 4"f.[illegible]; 1'2"f.[illegible]; 2¼"carb.sh; 4"(bkn) coal; ¼"carb.sh; Floor: 1 gy.silts.

Excl. Excl. Excl.

Overall recovery 95·3%

WORKING SEAM

N.S. 74

Ash & S.G.	Recovery per cent	Section Sampled	Seam Section	Description
Ash 25·4 S.G. 1·44	80·5%			[illegible] 4¼"(bkn) coal; 8"carb.sh; 1'3½"d.gy.sh.& carb.sh; 1"(b) coal; 1'2"(bkn) coal & inf coal w. ½" carb.sh. at 9½" & ½"m.gy.sh. at 11"; Floor: carb.sh.

Excl. Excl. Excl.

Overall recovery 80·5%

WORKING SEAM

N.S. 75

Ash & S.G	Recovery Per cent	Section Sampled	Seam Section	Description
Ash 31·9 S.G. 1·51	87·6%			Roof: f.gy.sh.; 2"carb.sh; 5½"(part) (bkn) coal; 1¾"carb.sh; 4"coal; 1½"carb.sh.; 1"of coal; 3½"(bkn) coal; 4¾"(& bkn) m.gy.sh; 1'3"(bkn) coal; ¾"carb.sh; 1"d.gy.sh; 4½"(bkn) coal; ½"l.gy.sh; 9½"(bkn) coal → inf. coal in btm. 4"; 1'4¾" m.gy. → d.gy.sh; ¼"(& bkn) coal; 1"m.gy.sh; 2'2"(p & b) coal & inf coal; ¾"d.gy.sh; 4"d.gy.sh. w. tiny nodules of l.carb. in btm 2"; 10¼"(bkn) coal w. ¼"carb.sh. at 7"; Floor: 1 gy. slts.

Excl. Excl. Excl.

Overall recovery 87·9%

MINE WORKINGS 'A'

	Seam Section	Description
These bands are very variable.		Roof: s[illegible]; 2'2"c[illegible]; 1"carb.sh; [illegible]; 1'6"coal; [illegible]; 3"[illegible]; 4"coal; 5"coal; 1"carb.sh, 2"coal; 4"f.sh.; 8"coal; 1"gy.sh.; 4"coal; 1"l.gy.sh; ¾"coal; 4"carb.sh → d.gy.sh; 2"gy-wh.sh; 2"coal; 1½"lr.sp.; 7"coal; Floor: 1 gy.sh.

CONCLUSIONS

Diamond drilling carried out so far by the Mines Department in the Amberfield mine area has been limited to meeting emergencies. Nevertheless, this drilling has shown that prospects of finding good quality coal in the Working seam in the vicinity of the present pithead are not good. Because of seam deterioration and faulting to the west and pre-Tertiary erosion to the north-east, the only possible direction for colliery development is to the south-east. Access to the 105,000 tons of coal (ash content 25·4 per cent.) proved in this area by borehole N.S. 74 is unfortunately not now available due to pillar extraction. As a result, the colliery management have recently begun to develop a lower seam. Available information indicates that only a small area of workable coal can be expected. In view of this serious lack of readily available reserves and the paucity of reliable information about other potentially productive seams, the need for systematic exploratory diamond drilling is most urgent if production is to be maintained.

21st October, 1959.

S. G. Reid, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 312

COAL RESOURCES, ROSEWOOD-WALLOON COALFIELD

Rosewood No. 2 Mine Area
New Malabar Mine Area

By J. B. CAMERON, B.Sc.App. (Geol.), Geologist

Caledonian No. 5 Mine Area
Neath Mine Area—Supplement

By E. S. CHIU CHONG, B.Sc., Geologist

BRISBANE
By Authority: S. G. REID, Government Printer
1963

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Rosewood No. 2 Mine Area	1
New Malabar Mine Area	9
Caledonian No. 5 Mine Area	18
Neath Mine Area—Supplement	30

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (ROSEWOOD No. 2 MINE AREA)

By J. B. CAMERON

SUMMARY

Rosewood No. 2 mine area was tested by fourteen diamond drill holes, total footage drilled being 3,514 ft. 6 in. This report sets out the results of the drilling programme.

The seams tested in the area are described and correlated; variations in seam sections and intervals are traced; and the prospects of the area are assessed.

Measured reserves were established in the present working seam amounting to 490,000 tons with weighted average ash content of 18.1 per cent.

Further drilling would be required to test the possibility of workable coal in deeper seams in the southern part of the mine area.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

As part of the Department of Mines' programme of coal exploration on the Rosewood Coalfield, fourteen diamond drill holes, N.S. 99-112, were drilled by the Sullivan 22 H.D. No. 1 plant in the Rosewood No. 2 mine area from October, 1957, to February, 1958. Total footage drilled was 3,514 ft. 6 in. Poor core recovery in the upper seams in boreholes N.S. 100 and N.S. 104 necessitated the drilling of a second shallow hole at each of those sites—N.S. 101, redrill of N.S. 100 and N.S. 105, redrill of N.S. 104. Overall core recovery, however, was quite satisfactory, averaging 97 per cent.

All workable coal sections encountered during the drilling programme were examined by an Engineer Member of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone both underground and on the surface. All analyses were carried out by the Government Analyst. Seam correlation is based on geological work carried out by J. H. Reid (1922 and 1927) and the writer since 1957.

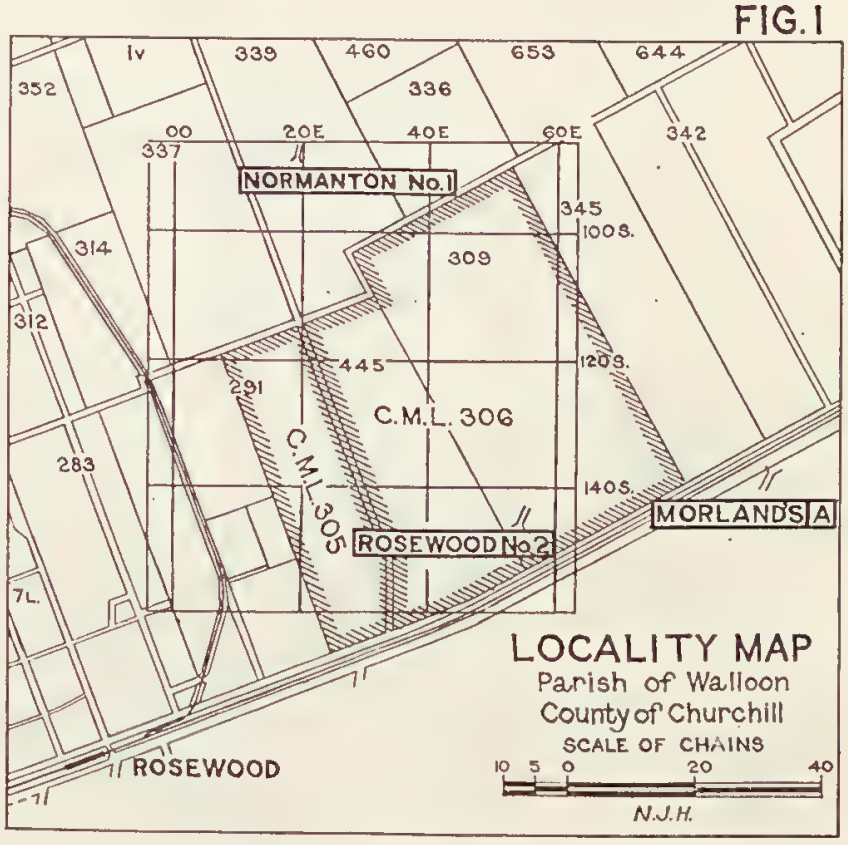
Accompanying the report are the following plans, sections and diagrams:—

(*a*) Locality Map—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and boundary of measured reserves—fig. 2.

(*c*) Generalised bore sections—fig. 3.

FIG. 1



(*d*) Diagrams of seams showing sections analysed and results—

Working seam—fig. 4.

Miscellaneous seams—fig. 5.

(*e*) Cross-section—fig. 6.

MINE WORKINGS

Rosewood No. 2 Colliery is situated one mile east-north-east of Rosewood Railway Station. The workings lie within Coal Mining Leases Nos. 305 and 306 held by Ernest Joynson and party trading as Rosewood Colliery Company.

Operations commenced in this mine area in the early 1920's when the Little Jim seam was worked for a short period from Bruce's tunnel. In 1931 these workings were reopened as Rosewood No. 1 Colliery but in the following year the Little Jim seam was abandoned in favour of another seam some 30 ft. below. This Bottom seam, as it is called locally, was worked from Rosewood No. 1 tunnel until 1941 when Rosewood No. 2 Colliery was opened about 15 chains to the south. The Little Jim seam was again worked here until 1947. In the meantime, the access tunnel was driven further to intersect the Bottom seam 20 ft. below. In 1944 an attempt was made to exploit a section of coal and shale bands about 7 ft. above the

FIG. 2

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

ROSEWOOD No. 2 MINE AREA
ROSEWOOD COALFIELD

Showing boreholes, mine workings, topography and boundary of measured reserves

To accompany report by J.B. Cameron B.Sc. App. (Geol), Geologist

Topographic Survey by E. Cowley

Scale of Chains

5 0 5 10 15 20

Twenty chain grid on True North. Point of origin, Perry's Knob Trig. Stn.

Elevations in feet on State Datum

LEGEND

Colliery (Working) — NEATH — Diamond drillhole — ◎ N.S.1

Colliery (Abandoned) — NEATH A — Percussion drillhole — o Bore (P)

Shaft — Seam section measured — ⊕ A

Fault — U/D — Adit

Surface contours — 60 — Cross section line X——X'

Elevations taken from mine plans and reduced to State Datum o 27'

Limit of mine workings :—

Little Jim Seam ++++++++

Middle Seam —·—·—·—·—

Btm. Seam — — — — —

Boundary of measured reserves :—

Btm. Seam ————

N.J.H.

NORMANTON No.1

EDENBANK A

◎N.S.24
R.L. Coll. 244·50
R.L. Surf. 243·34

◎N.S.22
R.L. Coll. 226·40
R.L. Surf. 225·15

◎N.S.112
R.L. Coll. 211·75
R.L. Surf. 210·45

◎N.S.23
R.L. Coll. 248·81
R.L. Surf. 247·51

◎◎N.S.100/101
R.L. Coll. 186·85
R.L. Surf. 185·60

◎N.S.104/105
R.L. Coll. 21·40
R.L. Surf. 210·28

◎N.S.103
R.L. Coll. 193·75
R.L. Surf. 192·60

ROSEWOOD No.1 A

◎N.S.111
R.L. Coll. 188·63
R.L. Surf. 187·43

◎N.S.106
R.L. Coll. 177·50
R.L. Surf. 176·26

◎N.S.110
R.L. Coll. 177·77
R.L. Surf. 176·57

◎N.S.102
R.L. Coll. 165·55
R.L. Surf. 164·40

ROSEWOOD No.2

◎N.S.99
R.L. Coll. 142·00
R.L. Surf. 140·79

◎N.S.107
R.L. Coll. 164·95
R.L. Surf. 163·80

◎N.S.109
R.L. Coll. 154·95
R.L. Surf. 153·75

◎No.2 GOVT. BORE
R.L. Surf. 147·35

◎N.S.108
R.L. Coll. 162·75
R.L. Surf. 161·50

100S 120S 140S

00 20E 40E 60E

Bottom seam; the workings in this Middle seam, however, were very limited (see fig. 2). In the following year, operations commenced in the Bottom seam, the horizon which has produced the bulk of the coal won from Rosewood No. Colliery in recent years.

GENERAL GEOLOGY

The coal seams worked to date in the Rosewood No. 2 mine area occur approximately 200 ft. below the top of the productive beds of the Walloon Coal Measures. The upper seams which have been eroded in this area are developed, however, immediately to the north in the adjacent Normanton No. 1 mine area where, as previously described (Cameron, 1959), the complete Jurassic coal-bearing sequence has been preserved by a protective capping of Tertiary basalt.

As is usual in areas of Walloon Coal Measure outcrop, very little information can be gained from surface exposures around Rosewood No. 2 Colliery. The establishment of a reliable stratigraphic column from ground observations is still further hindered here by the fact that the area constitutes a dip slope, a feature produced by the common, gentle southerly slope of the surface and underlying rocks. Consequently, present knowledge of the succession developed in the Rosewood No. 2 mine area has been gained almost entirely from subsurface investigations.

SUBSURFACE GEOLOGY

The topmost seam developed in the Rosewood No. 2 mine area—the **Little Jim seam**—is overlain by at least 56 ft. of non-productive strata, predominantly sandstone. As exposed in the No. 2 tunnel, this seam is 4 ft. 6 in. thick and comprises 2 ft. of top coal with one thin fawn shale band and 1 ft. of bottom coal, separated by 1 ft. 6 in. of grey shale with several thin bands of coal. The section worked in Rosewood No. 2 Colliery is reported to have been of similar form. However, in all boreholes except N.S. 99 which is adjacent to the old workings, the seam is rendered unworkable by the growth of the shale between "tops" and "bottoms" to as much as 9 ft. and the thinning of the top coal, in some cases to only a few inches.

In the access tunnel of Rosewood No. 2 Colliery, the Little Jim seam is separated by 2 ft. of light-coloured, waxy shale—locally termed "bentonite"—from the underlying **Middle seam,** a succession of coal and shale bands 8-9 ft. thick. Although varying greatly in thickness from a few inches to over 6 ft., this characteristic clay band occupies a similar stratigraphic position throughout the mine area and so is a very useful marker bed. In the vicinity of boreholes N.S. 102, N.S. 106, and N.S. 109, there is 12-20 ft. of strata between these two seams, the increased interval being due to the presence of lenticular beds of light grey shale both above and interbedded with the "bentonite". As penetrated in the diamond drill holes, the Middle seam varies from 3½-9 ft. thick but nowhere does it present a workable section because of its high proportion of shale bands.

The **Rosewood No. 2 Bottom seam** was first worked in Rosewood No. 1 Colliery where, it is reported, it was 3 ft. 9 in. thick comprising three sections of coal—8 in. of "tops", 1 ft. 8 in. of "middles" and 11 in. of " bottoms"—separated by two persistent bands of grey shale, and lying some 20 ft. below the Middle seam. To the east, the seam is said to have been seriously affected by contemporaneous erosion. Over the greater part of the Rosewood No. 2 Colliery workings, however, the Bottom seam is 4 ft. 9 in. thick, this increase being due to the growth of the top coal to 1 ft. 8 in. Furthermore, the interval between the Middle and Bottom seams thins rapidly in this direction so that the present **Rosewood No. 2 working seam** consists of the Bottom seam plus the lower coal plies of the Middle seam. The thickness of Middle seam coal incorporated in the working section at any point depends on its local quality, being as much as 2 ft. in the south but decreasing to only 9 in. in the north. In the northern part of the colliery, the working seam thickness is further reduced by the splitting off of the bottom 11 in. of coal by up to 1 ft. 6 in. of shale. Prior to the commencement of the diamond drilling programme, the limit of workability in the Rosewood No. 2 working seam had been reached only in the north-eastern workings where, in addition to the reduction in the seam section previously described, deterioration of the "tops" of the Bottom seam also occurs, accompanied by rapid growth of the stone between the Middle and Bottom seams. The behaviour of the Rosewood No. 2 working seam throughout the colliery is illustrated by sections A-D, fig. 4.

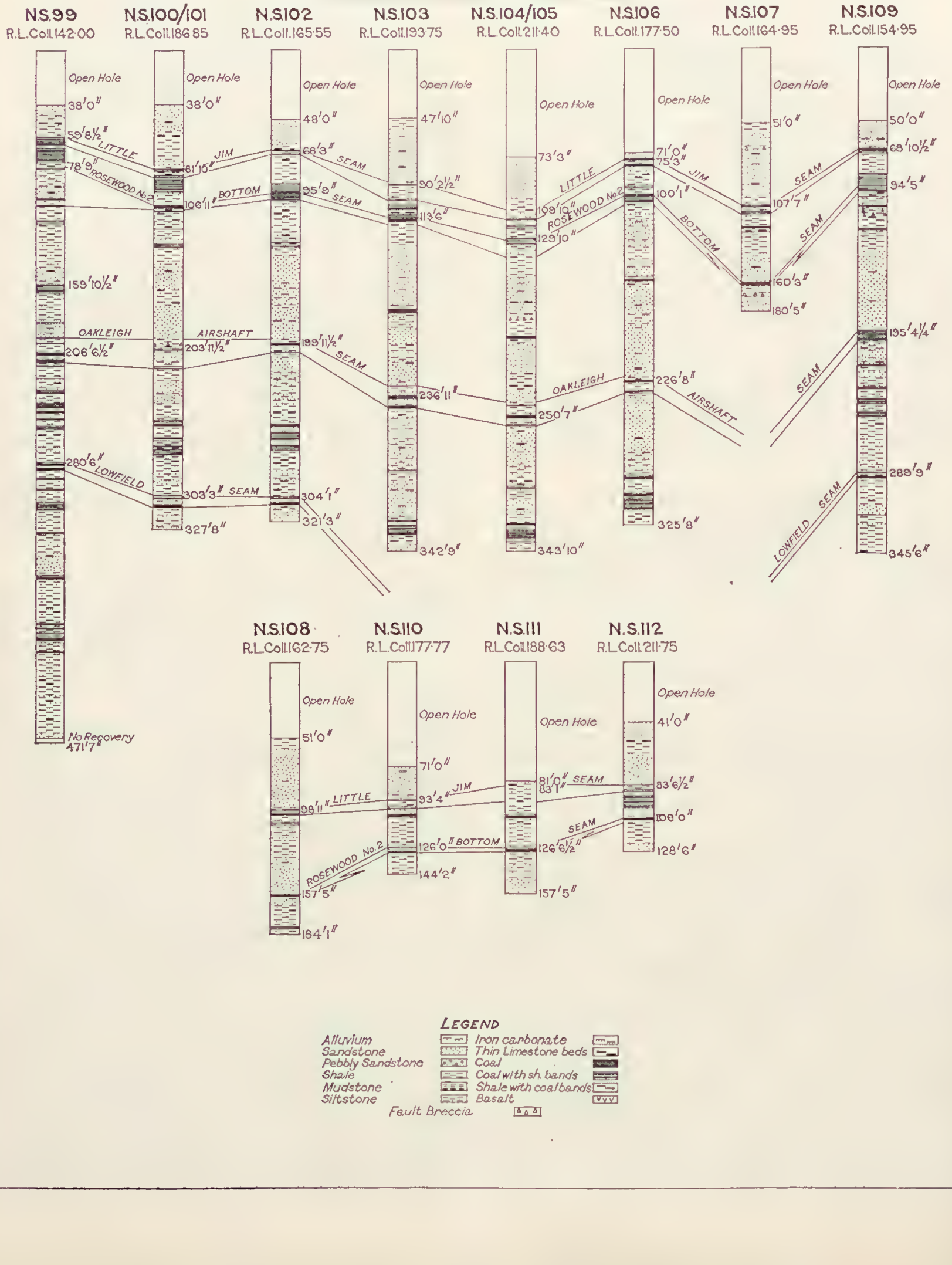
Although considerable variation is shown by the Rosewood No. 2 working seam in the various boreholes drilled, the same general pattern of behaviour seen in the mine workings is again evident. In that row of boreholes immediately to the west of the present workings, N.S. 102-106 and N.S. 109, the Middle and Bottom seams are separated by only ½-8 in. of shale. Potential working sections in the most northern of these boreholes are considerably thinner than those in the south because of the two factors previously mentioned—reduction northwards in the thickness of clean Middle seam coal available and the splitting off in that area of the 11 in. of bottom coal. In the most westerly boreholes, N.S. 107-108 and N.S. 110-111, the Middle seam lies at intervals ranging from 17 to 47 ft. above the Bottom seam and so is of no economic interest. The bottom coal of the Bottom seam is not represented in this area except by a few inches of coal and carbonaceous shale in N.S. 108; furthermore, in boreholes N.S. 107-108, deterioration of the "tops" results in a seam thickness thereabouts of no more than 2 ft. Around boreholes N.S. 110-111, however, the top coal is well developed, being about 1 ft. 6 in. thick. Poor core recovery in the "middles" of the Bottom seam in these drill holes, however, makes appraisal difficult as the overall seam thickness is only about 3 ft. 6 in. The prospecting shaft sunk in this area some years ago (see fig. 2) is of little help in this respect as only the Little Jim seam was exposed. In those boreholes drilled to the north-east

FIG.3

ROSEWOOD No.2 MINE AREA
GENERALISED BORE SECTIONS

SCALE OF FEET

50 0 50 100 150



LEGEND

Alluvium	Iron carbonate
Sandstone	Thin Limestone beds
Pebbly Sandstone	Coal
Shale	Coal with sh. bands
Mudstone	Shale with coal bands
Siltstone	Basalt
Fault Breccia	

ROSEWOOD No.2 MINE AREA – DETAILED SEAM SECTIONS
WORKING SEAM

N.S.102

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 5.5 V.M.% 36.7 F.C.% 38.1 A% 19.7 S% 0.43 Joules/Gm. 25110 B.T.U./lb. 10800 S.G. 1.38	97.5	Excl. Excl.

93'11¼" 2" med.gy.sh. 1½" carb.sh. 1" wh.sh. 1" coal 3½" med.gy.→dk.gy.sh 1¾" carb.sh 3¼" (b.c) inf.coal & coal 3¼" l.gy.sh 2"
95'0¼" coal 2¾" dk.gy.sh 2¼" (p.b.c) coal ½" l.gy.sh ¼" carb.sh 1'7½" (p.b.c) coal with ½" med.gy.sh at 1'1½" 1" carb.sh ½" l.gy.sh 11¼" (p.b.c) coal 3" med.gy.sh 1" coal ¾" dk.gy.sh 1½" coal ½" l.gy.sh. 1'6½" (p.b.c) coal with ¼" med.gy.sh at 1'4¼" 4" carb.sh. 4" (p.b.c) coal ¾" med.gy.sh.
101'11¼" 3" inf.coal & coal
102'8" 8¾" l.gy.slts.

N.S.109

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 4.5 V.M.% 35.4 F.C.% 36.5 A% 23.6 S% 0.52 Joules/Gm. 24010 B.T.U./lb. 10330 S.G. 1.41	100	Excl.
M% 4.5 V.M.% 38.1 F.C.% 41.9 A% 15.5 S% 0.46 Joules/Gm 26850 B.T.U./lb. 11550 S.G. 1.35	86.9	Excl. Excl.

90'2¼" 3½" l.gy.sh ½" inf.coal 1½" (p.b.c) coal 3" inf.coal 2" carb.sh 4¼" (b.c) inf.coal 1¾" coal 2½" carb.sh 3¾" coal 2¼"
92'4¼" med.gy.sh 3¼" (p.b.c) coal ¾" gy-wh.sh 3½" coal 1¼"
93'8¾" carb.sh 1¾" coal ¾" carb.sh 3" coal ½" carb.sh. ¾" coal
94'4¾" 5" dk.gy.sh 1¾" med.gy.sh 1½" (p.b.c) coal 5¼" (p.b.c) inf.coal 2½" (p.b.c) coal 6" med.gy.sh. 1¼" inf.coal 1" (b.c) coal 1¼" inf.coal 2½" coal 1¾" carb.sh 3½" med.gy.sh ¾" (b.c) carb.sh. 3½" l.gy.sh. 1'0½" coal
98'10" 4" coal 1" dk.gy.sh 1¼" coal ¾" carb.sh ¼" coal 6½" carb.sh. 2" coal 3¼" carb.sh. 2½" inf.coal & coal l.gy.sh.→slts. in places

N.S.105

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
Section normed		

7'2½" 2½" gy.sh. 2" inf.coal 1½" f.wn.sh 1½" dk.gy.sh. 5½" inf.coal 9½" coal with ½" gy.sh at 2½" & 1" carb.sh at 6" 1½" f.wn.sh 10½" coal with two ½" carb.sh bands at 4" & 6½" 3" carb.→dk.gy.sh 1'7½" coal with ¼" gy.sh at 3" 2" gy.sh 2" carb.sh 1'7" coal 3" gy.sh. 3" inf.coal 8" coal shale

N.S.110

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 5.4 V.M.% 36.2 F.C.% 40.2 A% 18.2 S% 0.47 Joules/Gm 25390 B.T.U./lb. 10920 S.G. 1.39	68.0	Excl Excl Excl

gy-wh f.ss.
126'1¾" ½" coal 1" carb.sh. 2" (b.c) coal 3¾" inf.coal 1" carb.sh 2¾" (b.c) coal 1" l.gy.sh 1½" (b.c) coal 1" dk.gy.sh 2¼" carb.sh ½" gy.-wh.sh 2½" l.gy.sh 1'0½" (b.c) coal
129'11" l.gy.sh.→med.gy.sh. in places

N.S.111

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 6.1 V.M.% 36.1 F.C.% 41.0 A% 16.8 S% 0.54 Joules/Gm. 25230 B.T.U./lb. 10850 S.G. 1.39	91.9	Excl Excl Excl

med.gy.sh
126'6½" 1½" l.gy.wa.xy.sh 2¾" inf.coal 3¼" coal 2" med.gy.sh →dk.gy.sh 4¼" coal 1½" carb.sh 3¾" (b.c) coal ¾" inf.coal 1" dk.gy.sh 1'7¼" (b.c) coal
130'1" l.gy.slts.

N.S.105

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 4.5 V.M.% 37.3 F.C.% 35.9 A% 22.3 S% 0.60 Joules/Gm. 24610 B.T.U./lb. 10590 S.G. 1.44	70.0	Excl Excl

128'3¼" ½" dk.gy.sh 2½" wh.f.ss.
129'2¼" ½" carb.sh ¾" inf.coal 7¼" dk.gy.sh. 3½" (b.c) coal 1" carb.sh 7½" coal 2" dk.gy.sh 5" coal 2¼" f.wn.sh 5¼" (b.c) coal ½" carb.sh. 1¼" coal ¾" interb.carb.&gy.sh 9½" (p.b.c) coal
133'8½" l.gy.sh

N.S.103

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 4.5 V.M.% 39.2 F.C.% 40.0 A% 16.3 S% 0.52 Joules/Gm 26590 B.T.U./lb 11440 S.G. 1.38	88.9	Excl. Excl.

112'7¾" ¼" dk.gy.sh 4" med.gy.sh
113'5¾" 1¼" coal 1½" carb.sh. 1¾" coal ¼" dk.gy.sh 1" med.gy.sh 4½" (p.b.c) coal ½" carb.sh. 6½" (p.b.c) coal 2" f.wn.sh. 4¼" (p.b.c) coal ½" med.gy.sh 2'4" (p.b.c) coal with ¾" dk.gy.sh at 9¼"
117'9¾" 1'4¼" l.gy.slts.
119'4½" 1" l.gy.sh ¼" med.gy.sh ¾" carb.sh ½" coal

N.S.106

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 5.4 V.M.% 38.2 F.C.% 41.2 A% 15.2 S% 0.45 Joules/Gm. 26900 B.T.U./lb. 11570 S.G. 1.45	98.3	Excl. Excl.

99'0¼" 1½" carb.sh →inf.coal 4¾" l.gy.sh ¼" carb.sh
100'1¼" 1½" coal 2" carb.sh. ¾" coal 1¼" l.gy.slts. 1'2¾" (p.b.c) coal 1½" dk.gy.sh 1" l.gy.sh. 10½" (b.c) coal ¾" dk.gy.sh ¾" carb.sh ¾" coal 1" interb.carb.sh & coal 2'0" (b.c) coal
104'11½" ½" (p.b.c) f.wn.sh 1¾" (p.b.c) coal & inf.coal ¼" carb.sh
105'7¾" 8" med.gy.sh.→l.gy.sh.

N.S.100

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
M% 6.3 V.M.% 38.8 F.C.% 41.9 A% 13.0 S% 0.51 Joules/Gm. 27270 B.T.U./lb. 11730 S.G. 1.35	95.3	
M% 6.8 V.M.% 32.5 F.C.% 40.0 A% 20.7 S% 0.48 Joules/Gm. 24100 B.T.U./lb. 10370 S.G. 1.56	87.0	

106'1" dk.gy.sh.→med.gy.sh. in places ¼" carb.sh. 2'1½" (p.b.c) coal with ½" gy.sh at 3½"
109'1¾" 5¼" l.gy.slts.
110'3½" 6" l.gy.sh. 2½" carb.sh. 10" (p.b.c) coal with ½" dk.gy.sh at 5" ¼" carb.sh.
111'3" 2¾" med.gy.sh ½" dk.gy.sh. 2" carb.sh with ¼" f.wn.sh at ½" 2" dk.gy.sh.

A

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
Section worked		

2½" coal ½" gy.sh 1½" coal. 1" gy.sh. 2" coal 1½" f.wn.sh. 8½" coal ½" carb.sh. 1'9" coal with ½" gy.sh at 6½" ½" gy.sh. 1'8½" coal 1'5" l.gy.slts. 3" inf.coal 8" coal
4'4"

D

Prox Analysis S, Cal Val & S.G.	Recovery per cent	Section Sampled
Section worked		

1" f.wn.sh. 1'2" coal 1'0" l.gy.f.ss. 10½" gy.sh. 3" carb.sh. 2'3" coal with two ½" carb.sh. bands at 1" & 7" 5" l.gy.sh. 1" coal with 1" gy.sh at 1" & ¾" gy.sh at 7" shale
3'7"

of the colliery workings, N.S. 100-101 and N.S. 112, the Rosewood No. 2 working section is of similar form to that exposed in the most advanced working places. In borehole N.S. 99 to the south-east of Rosewood No. 2 tunnel, the three sections of coal in the Bottom seam can be recognised but are separated by excessively thick beds of stone, there being 20 ft. of sandstone, siltstone and shale between "tops" and "middles" and 3½ ft. of siltstone and shale between "middles" and "bottoms". In the No. 2 Government Bore drilled by the Mines Department in 1926 at a point some 26 chains south-west of Bruce's tunnel (see fig. 2), the Bottom seam is similarly affected although the splitting is by no means as severe. Details of workable sections penetrated in the Rosewood No. 2 working seam during the recent drilling programme are shown in fig. 4 along with analytical results.

In recording the results of the No. 2 Government Bore mentioned above, Reid (1927) stated that the seams "between 78 ft. and 132 ft. include very probably the horizons which embrace No. 1 to No. 4, Rosewood seams, several of which have been worked in Perry's Nob, Glencoe, Edenbank, and Normanton collieries." Earlier (Reid, 1922), he had estimated the top seam of this group, that is, the Little Jim seam of present terminology, "to be some 70 ft. below the horizon of the Edenbank seam." As a result of the recent diamond drilling programme in the Rosewood No. 2 mine area and previous drilling around Normanton No. 1 Colliery to the north, the latter view is now known to be the correct interpretation, the Little Jim, Middle and Bottom seams of the Rosewood No. 2 area lying stratigraphically 50-100 ft. below the Rosewood seams which have been exploited around the slopes of Perry's Knob. The Bottom seam can be readily correlated with the **New Malabar seam** of the Normanton No. 1 mine area, and the Middle seam with the persistent coal horizon and associated "bentonite" usually 20-30 ft. above (Cameron, 1959).

In borehole N.S. 99 there is another workable coal **seam 53 ft. below the Bottom seam** (see fig. 5). This seam was penetrated in six other boreholes, N.S. 100, N.S. 102-104, N.S. 106, and N.S. 109 at intervals ranging from 20 to 60 ft. below the Bottom seam but all these sections were unworkable. In the airshaft near Rosewood No. 2 tunnel, however, the seam is reported to be over 7 ft. thick but split by a 2 ft. shale band into 4 ft. of top coal and 1 ft. 3 in. of bottom coal, both of these sections containing several thin shale bands. The seam was also tested in the airshaft 26 chains to the north-west of the No. 2 tunnel but was unworkable. If an area of workable coal exists in this seam, it will lie to the south of the existing leases. The only information available in this area is that recorded by Reid (1922) from the old Morland's Colliery (see fig. 1) which was worked about sixty years ago. Approximately 150 ft. of strata were tested there by a shaft and bore and only one workable seam encountered at 100 ft. This seam most likely is equivalent to the Rosewood No. 2 Bottom seam. Prospects of finding a large area of coal in the seam 20-60 ft. below the Bottom seam

FIG. 5

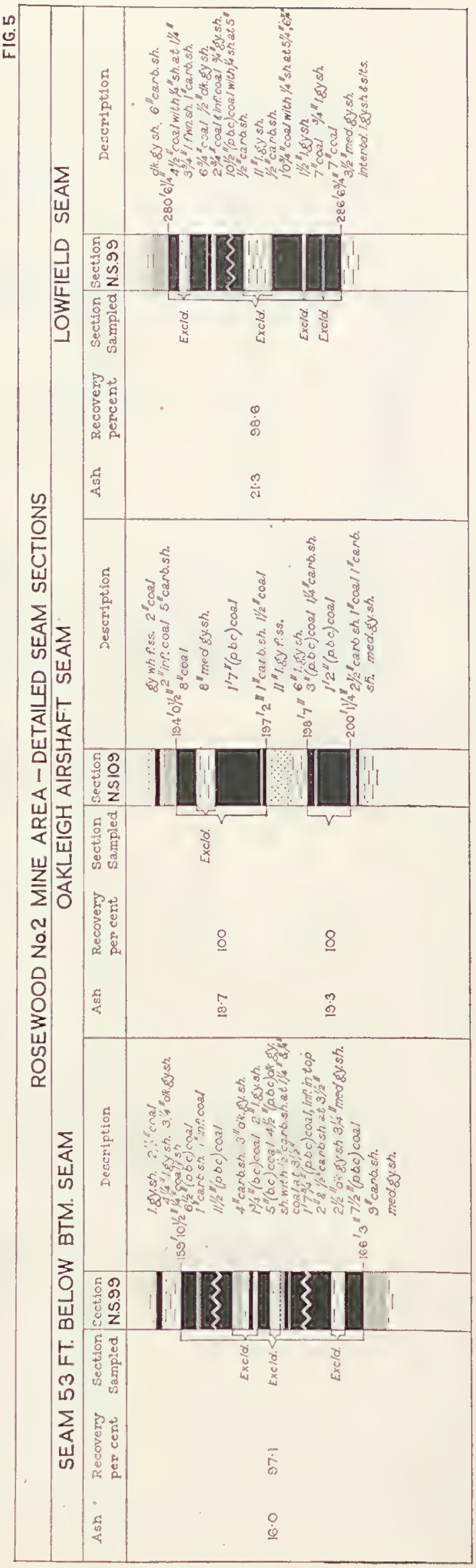
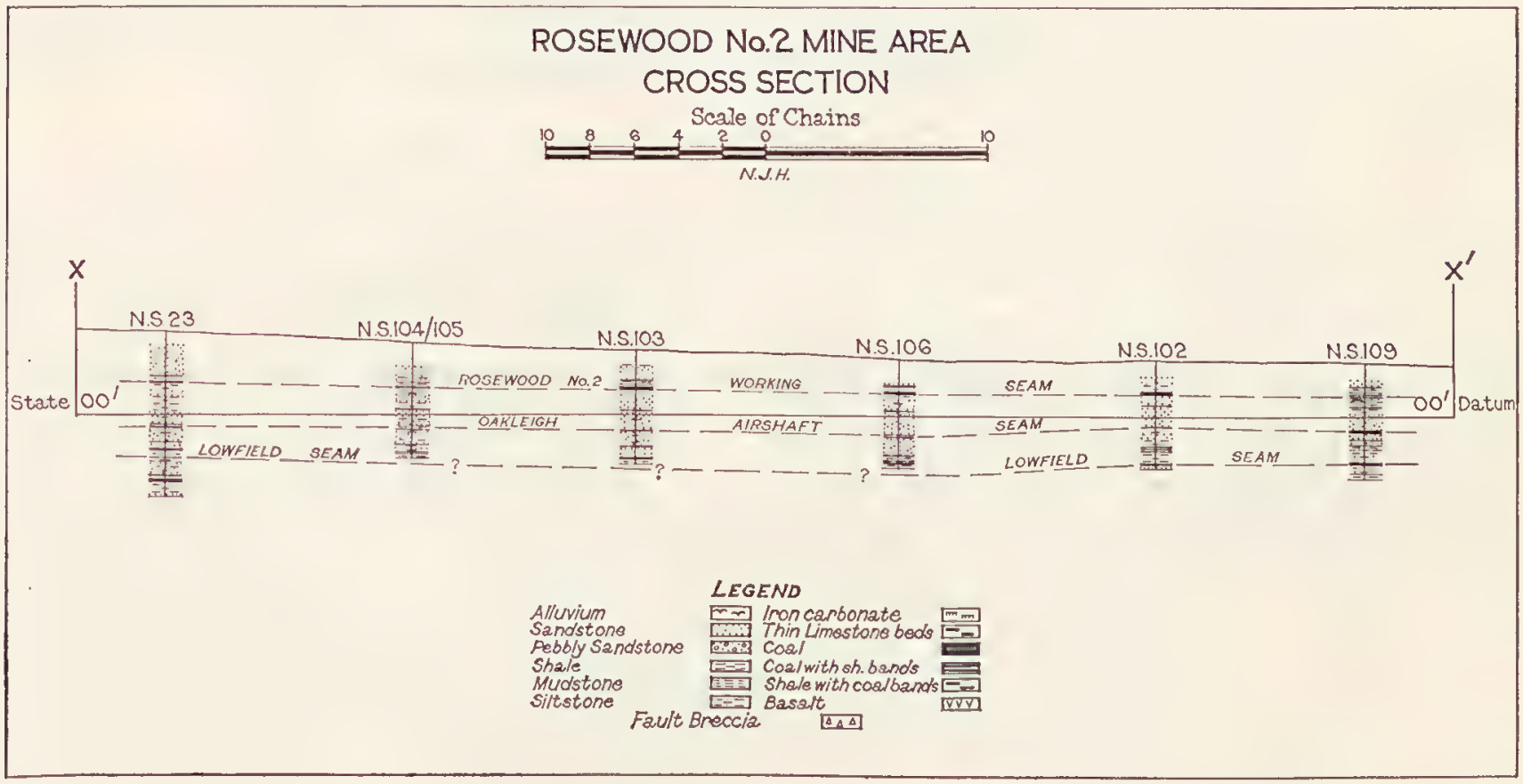


FIG.6



are, therefore, not good, particularly as this seam does not represent one of the recognised horizons containing minable coal within the Walloon Coal Measures.

Drilling was continued in borehole N.S. 99 to a depth of 471 ft. 7 in. and approximately another 250 ft. of coal-bearing strata were encountered below the abovementioned seam. Several potentially workable seams occur in this part of the succession and these were thoroughly tested during the remainder of the drilling programme (see fig. 3). However, only two workable sections were penetrated, one at 194 ft. 0½ in. in borehole N.S. 109, the other at 280 ft. 6 in. in N.S. 99 (see fig. 5). These seams can be correlated with the **Oakleigh Airshaft seam** and the **Lowfield seam** respectively described from the Oakleigh mine area (Cameron, 1961).

STRUCTURAL GEOLOGY

The structure of the Rosewood No. 2 mine area is very simple. Regional dip is approximately 2 degrees to the south but local irregularities both in direction and magnitude do occur (see fig. 6). No major faulting has been encountered to date in the colliery workings, an advantage which the drilling results suggest will not be lost in future mining operations.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3 ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings):—

(*a*) measured reserves—up to 12½ chains.

(*b*) indicated reserves—more than 12½ chains.

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

Measured reserves were established by the drilling programme only in the **Rosewood No. 2 working seam.** These reserves totalling 490,000 tons lie to the west of the present workings within an area of 62 acres embracing boreholes N.S. 102-106, N.S. 109 and N.S. 111 (see fig. 2). Except around the last borehole where only the Bottom seam is workable, the working section comprises the Bottom seam plus the lower coal plies of the Middle seam. Seam thickness ranges from 3 ft. 6½ in. (N.S. 111) to 6 ft. 6 in. (N.S. 109), the average thickness of coal being 4 ft. 7½ in. The reserves have a weighted average ash content of 18·1 per cent.

NATURE OF COAL

The coal in the Rosewood No. 2 working seam is of high volatile bituminous rank. Dry, mineral-matter-free fixed carbon ranges from 50·37 to 54·21 per cent. while calorific value, calculated on a moist, mineral-matter-free basis, ranges from 13,260 to 13,970 B.Th.U. per lb.

CONCLUSIONS

Although some 350 ft. of coal-bearing strata were tested by the diamond drilling programme in the Rosewood No. 2 mine area, measured reserves were established only in the present working seam. These reserves with a weighted average ash content of 18·1 per cent. total 490,000 tons. It is probable that further reserves exist to the west of the area defined towards borehole N.S. 110 but poor core recovery in the Bottom seam in that hole makes accurate appraisal difficult.

Of the seams encountered in the lower part of the succession, only three are of economic interest—a seam 53 ft. below the Bottom seam in borehole N.S. 99, the Oakleigh Airshaft seam in N.S. 109 and the Lowfield seam also in N.S. 99. Although no workable coal was penetrated in any of these seams in the other holes drilled to intersect them, areas of workable coal could exist in the southern part of the mine area and beyond. These prospects could best be tested by further diamond drilling.

REFERENCES

CAMERON, J. B., 1959: Coal resources—Rosewood-Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

————, 1961: Coal resources—Rosewood-Walloon coalfield (Oakleigh mine area). *Qld Govt Min. J., 62,* 416-427.

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

————, 1927: Coal mining and boring operations, etc., Rosewood. *Qld Govt Min. J., 28,* 4-8.

12th July, 1960.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(NEW MALABAR MINE AREA)

By J. B. CAMERON

SUMMARY

Departmental drilling in 1953 established reserves totalling 550,000 tons, workable from New Malabar Colliery, but direct access to these reserves was lost when the colliery was abandoned in the following year.

To test the possibility of access from the south-eastern slopes of Perry's Knob, three percussion holes were later drilled by the colliery management. Results obtained justified Departmental diamond drilling, and eight boreholes, totalling 1,827 ft. 3 in. were drilled in 1960 to test the area.

Because of pronounced splitting of the seam in the area of access, it is considered that any exploitation will be limited to the "bottoms" of the New Malabar seam, except perhaps in the western part of the area. With changed conditions of access and different mining methods, part of the previously estimated reserves are unlikely to be available. A reassessment of workable reserves has therefore been made, based on the results of all drilling and assuming that only the "bottoms" will be worked.

In an area of 68 acres, the working section ranges in thickness from 3 ft. 2¼ in. to 4 ft. 9½ in., average thickness of coal being 3 ft. 2½ in. Indicated reserves with a weighted average ash content of 15.8 per cent. total 365,000 tons.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

When New Malabar No. 1 Colliery was abandoned in 1954 due to inability to control roof pressure, ready access was lost to the measured reserves, totalling 550,000 tons, which had just recently been established in the working seam by a Department of Mines' programme of exploratory diamond drilling (Hawthorne, 1954). A further attempt to reach these reserves by means of a new tunnel (New Malabar No. 2) was made in the period 1954-56 but without success. Three percussion boreholes were then drilled by the colliery management on the south-eastern slopes of the Perry's Knob feature to see if exploitation could be effected from that direction. The results of this prospecting were sufficiently encouraging to warrant further Departmental exploration.

In February-April, 1960, an additional eight boreholes, N.S. 186-193, were drilled by the Sullivan 22 H.D. No. 1 plant immediately to the south-east of the area tested in 1953. Aggregate footage drilled was 1,827 ft. 3 in., overall core recovery being 91·0 per cent. Due to poor recovery in the top seam in borehole N.S. 191, a second shallow hole, N.S. 192, was drilled at that site.

All workable coal sections encountered during the drilling programme were examined by an Engineer Member of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone both underground and on the surface. All analyses were carried out by the Government Chemical Laboratory. Seam correlation is based on geological work carried out by Hawthorne (1954 and 1955) and the writer since 1956, supported by the palynological studies of de Jersey (1955*a* and *b*).

Accompanying this report are the following plans, sections and diagrams:—

(*a*) Locality Map—fig. 1.

(*b*) Plan showing positions of boreholes, extent of mine workings, surface contours at 20 ft. intervals and underground levels on State Datum, and boundary of indicated reserves—fig. 2.

(*c*) Generalised bore sections—fig. 3.

(*d*) Diagrams of seams showing sections analysed and results—

Rosewood seams—fig. 4.

New Malabar seam—fig. 5.

(*e*) Correlation diagram of New Malabar seam—fig. 6.

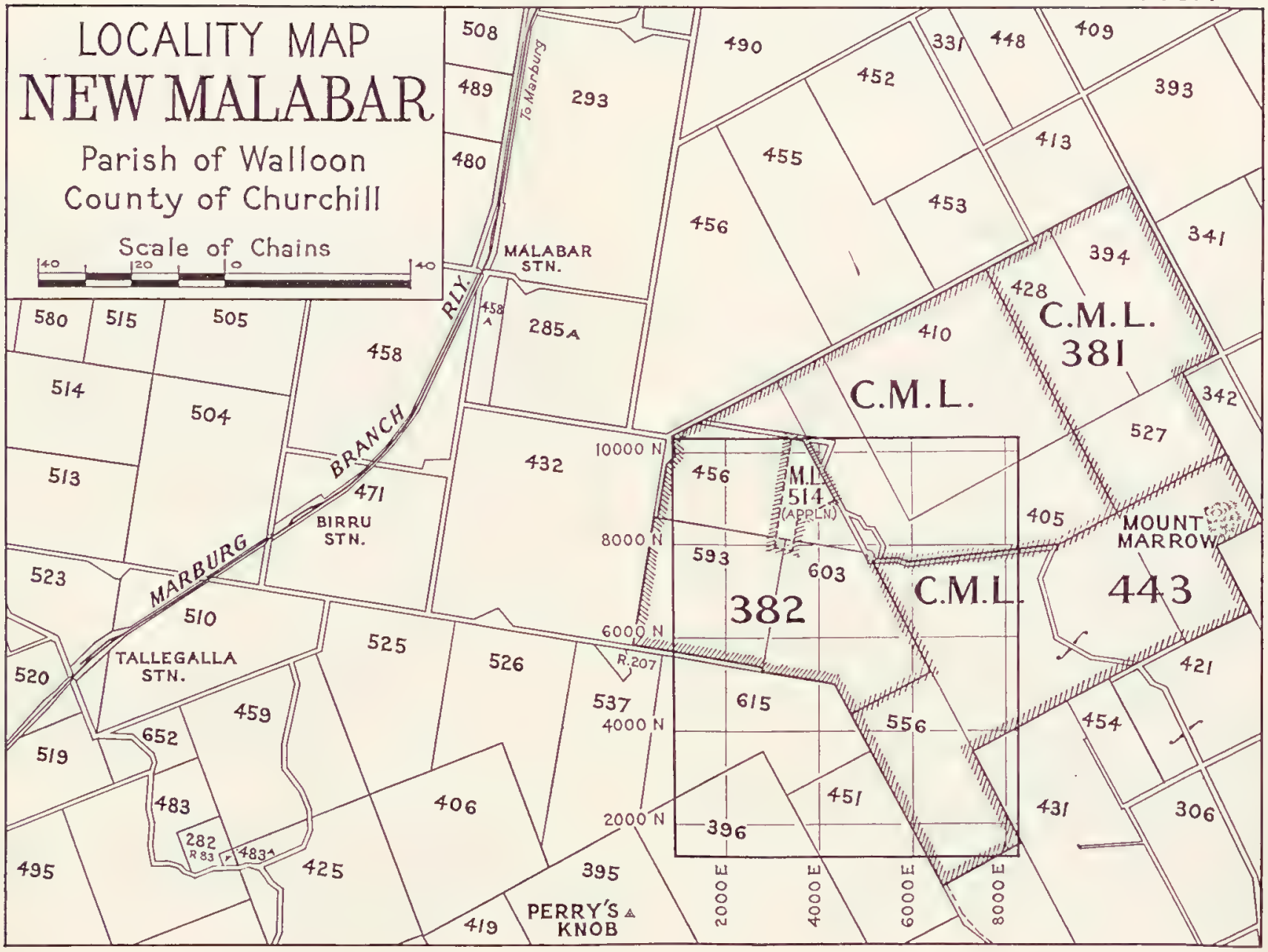
(*f*) Cross-section—fig. 7.

MINE WORKINGS

The abandoned Malabar Nos. 1-10 and New Malabar Nos. 1-2 Collieries, situated 1¼ miles east of Birru Railway Station and 3¼ miles north of Rosewood, lie within an area held by Noel Horace Roots as Coal Mining Leases Nos. 381, 382, and 443 and Mineral Lease (Application) No. 514 (see fig. 1). Prior to August, 1960, the area covered by M.L. (Application) No. 514 was part of C.M.L. No. 382.

When Malabar No. 1 Colliery was opened in 1929, some coal had already been produced in this area, the nearby Mountain Ash No. 2 Colliery having operated during 1925-26. This old pit was reopened in 1934 when it was renamed Malabar No. 2 Colliery. The coal produced from these collieries along with that from Malabar No. 3 tunnel all came from the same seam. In 1935, however, a second seam was exploited from Malabar No. 4 tunnel. These two

FIG. 1



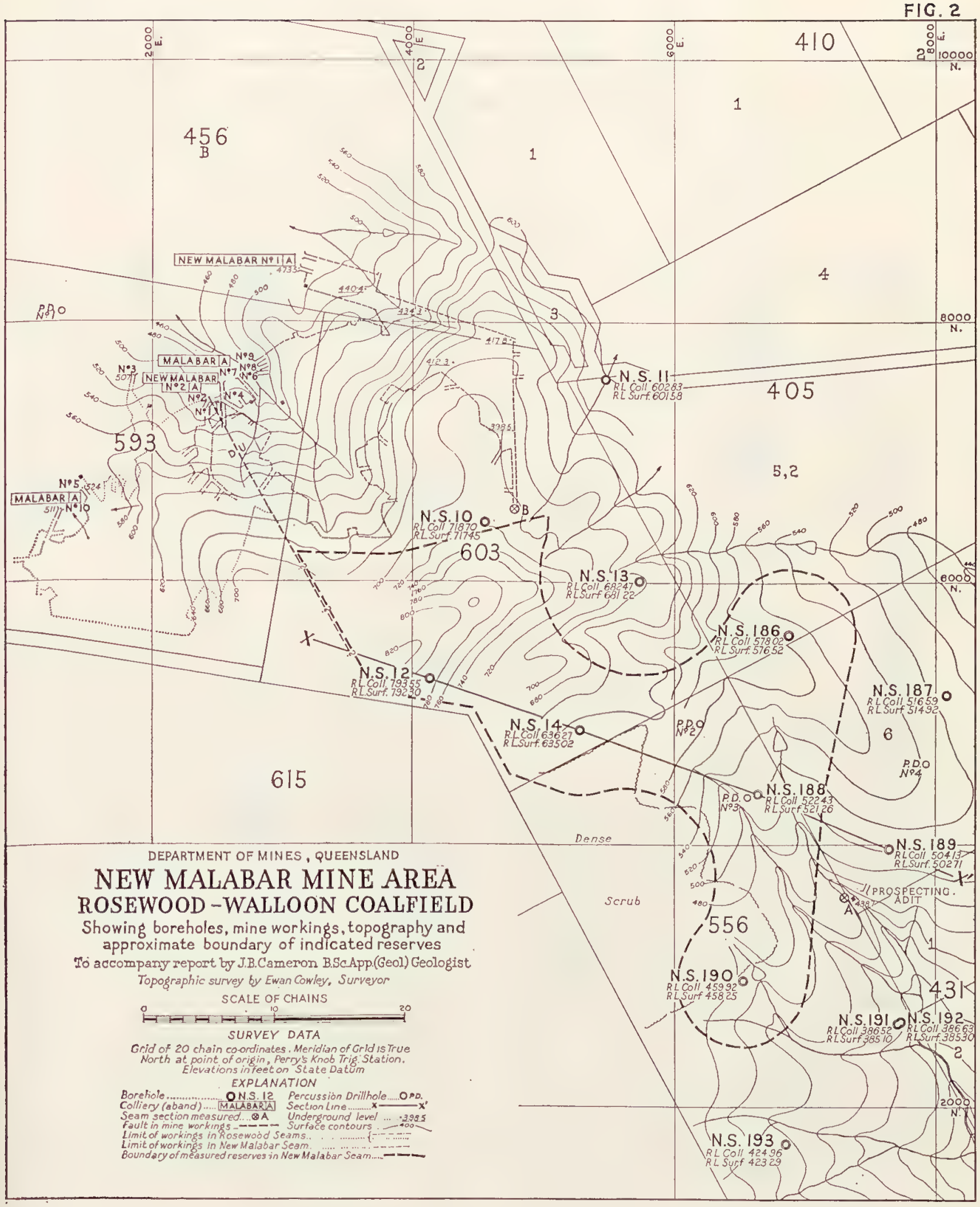
seams which were referred to as the Little and Big seams respectively were worked in subsequent years from another eight tunnels—the Little seam in Malabar Nos. 5 and 10 Collieries and the Big seam in Malabar Nos. 6-9 and New Malabar Nos. 1-2 Collieries. Because of faulting between the Little seam workings to the west and the Big seam workings to the east, the stratigraphic relationship between these two seams was not properly understood until 1953. As a result of the exploratory diamond drilling carried out in the Malabar area at that time by the Department of Mines, Hawthorne (1954) was able to show that the Little seam lay stratigraphically 85-110 ft. above the Big (or New Malabar) seam and that their juxtaposition in Malabar Nos. 1 and 4 Collieries was due to faulting, the downthrow to the south-west being almost the same as the interval between the two seams. A displacement of similar magnitude was proved in New Malabar No. 2 Colliery in 1955 when the Malabar fault was penetrated for the first time in underground workings. The seam worked here to the south-west of the fault (see fig. 2) is reported to lie several feet above the Little seam.

SUBSURFACE GEOLOGY

The occurrence of Tertiary basalt and sediments unconformably overlying the Walloon Coal Measures in this mine area has been recorded by Hawthorne (1954). No Tertiary basalt was penetrated in any of the boreholes drilled during the 1960 programme of coal exploration but in several holes Tertiary sediments were encountered (see fig. 3). The land surface upon which these Tertiary sediments were deposited was several hundred feet higher in the western part of the Malabar area and so it is there that the most complete Jurassic succession is developed (see fig. 7).

Towards the top of the Jurassic sequence as developed in the Perry's Knob area of the Rosewood Coalfield there occurs a readily recognisable succession of coal-bearing strata usually about 50 ft. thick. These beds were first described from the southern slopes of Perry's Knob by Reid (1922); the productive coal horizons he termed the **Rosewood seams**. As a result of the exploratory diamond drilling carried out in this area in recent years by the Department of Mines, these Rosewood seams can now be traced around the

FIG. 2



DEPARTMENT OF MINES, QUEENSLAND

NEW MALABAR MINE AREA
ROSEWOOD–WALLOON COALFIELD

Showing boreholes, mine workings, topography and approximate boundary of indicated reserves

To accompany report by J.B.Cameron B.Sc.App.(Geol.) Geologist

Topographic survey by Ewan Cowley, Surveyor

SCALE OF CHAINS

0 10 20

SURVEY DATA

Grid of 20 chain co-ordinates. Meridian of Grid is True North at point of origin, Perry's Knob Trig. Station. Elevations in feet on State Datum

EXPLANATION

Borehole ..... O N.S. 12
Colliery (aband) ..... MALABAR A
Seam section measured ... ⊗ A
Fault in mine workings ———
Limit of workings in Rosewood Seams . . . . .
Limit of workings in New Malabar Seam .....
Boundary of measured reserves in New Malabar Seam .....

Percussion Drillhole ..... O P.D.
Section Line ..... X ——— X'
Underground level ... 3985
Surface contours . 400

FIG. 3

NEW MALABAR

GENERALISED BORE SECTIONS

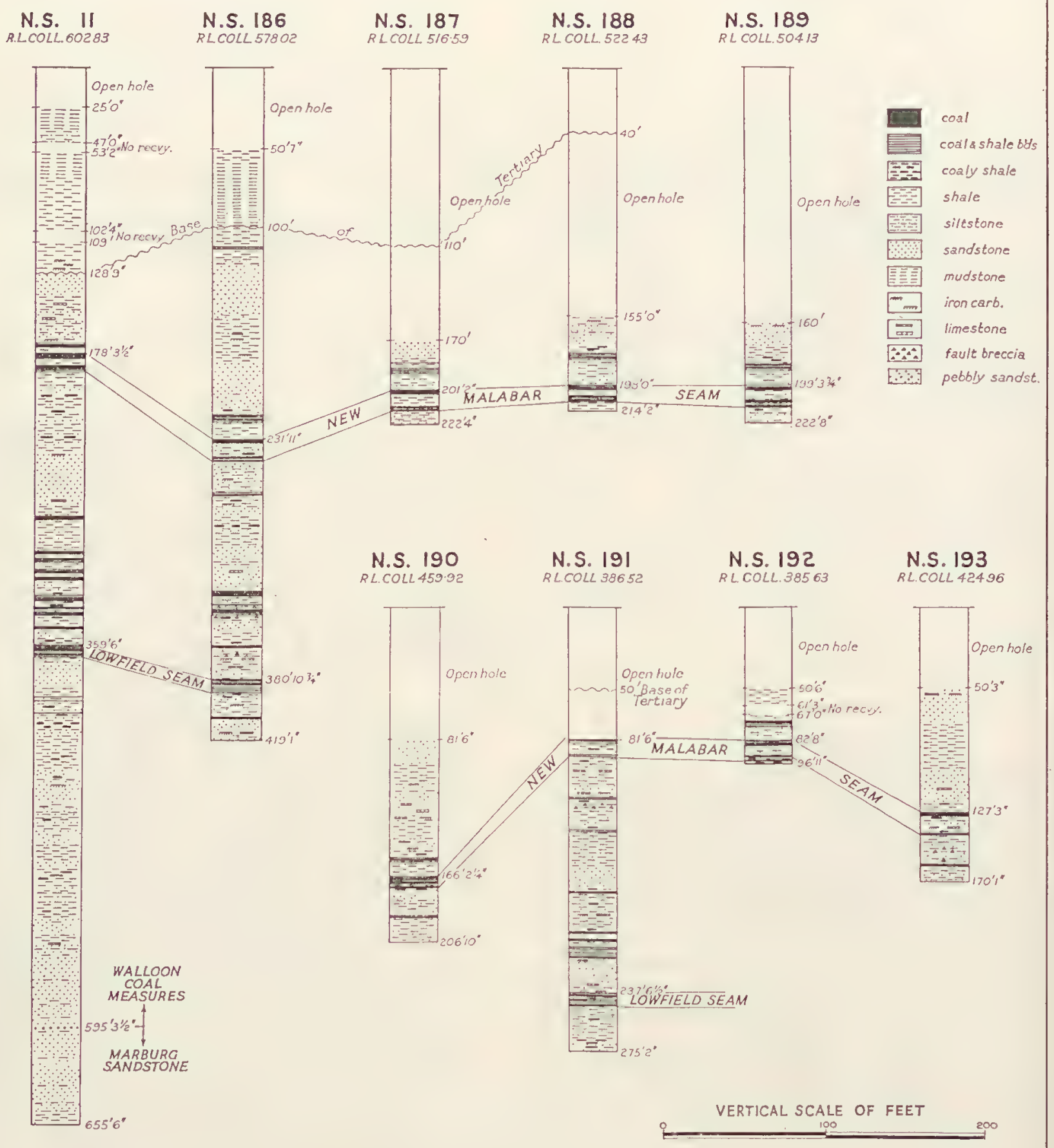
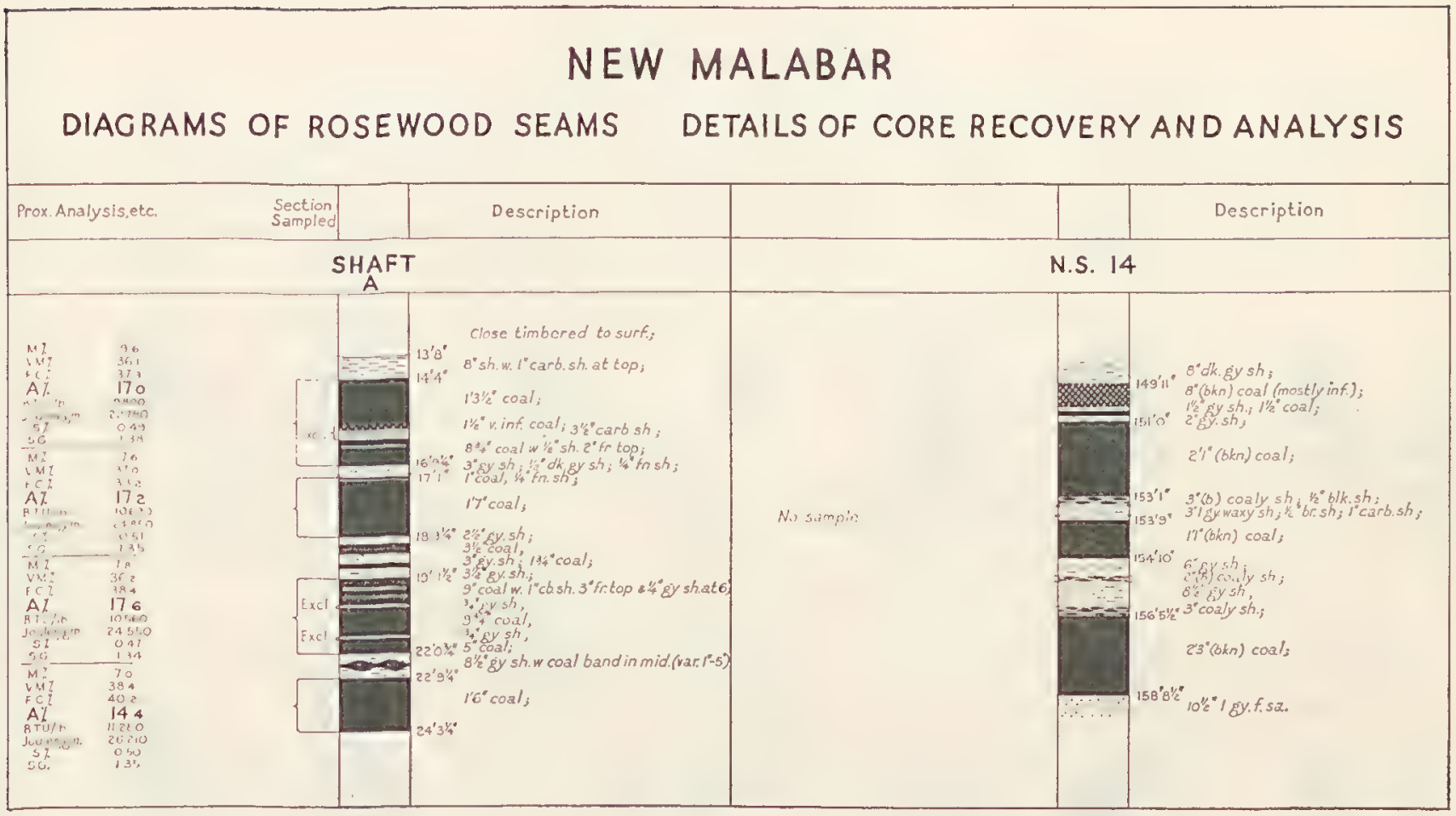


FIG. 4


NEW MALABAR
DIAGRAMS OF ROSEWOOD SEAMS DETAILS OF CORE RECOVERY AND ANALYSIS
Prox. Analysis, etc.
Section Sampled
Description
Description
SHAFT A
N.S. 14
Close timbered to surf.;
13'8"
8" sh. w. 1" carb. sh. at top;
14'4"
1'3½" coal;
1½" v. inf. coal; 3½" carb sh;
8¾" coal w ½" sh. 2" fr top;
16'9¾" 3" gy sh; ½" dk gy sh; ¼" fn sh;
17'1" 1" coal, ¼" fn. sh;
1'7" coal;
18'3¼" 2½" gy. sh;
3½" coal,
3" gy. sh; 1¾" coal;
19'1½" 3½" gy. sh;
9" coal w. 1" cb sh. 3" fr top & ¼" gy sh at 6;
3" gy sh,
9¼" coal,
¾" gy sh,
22'0¾" 5" coal;
8½" gy sh. w coal band in mid. (var. 1"-5")
22'9¾"
1'6" coal;
24'3¾"
Excl
Excl
No sample
149'11" 8" dk. gy sh;
8" (bkn) coal (mostly inf.);
1½" gy sh.; 1½" coal;
151'0" 2' gy. sh;
2'1" (bkn) coal;
153'1" 3" (b) coaly sh; ½" blk. sh;
153'9" 3'1 gy waxy sh; ½" br. sh; 1" carb. sh;
17" (bkn) coal;
154'10" 6" gy sh;
c" (b) coaly sh;
8½" gy sh,
156'5½" 3" coaly sh.;
2'3" (bkn) coal;
158'8½" 10½" 1 gy. f. sa.

northern slopes of the Perry's Knob feature to the Roughrigg and Malabar mine areas. In the former area they contain two productive horizons—the Roughrigg Top and Bottom seams; in the latter, only one seam has been worked to any extent—the Little seam which, as Hawthorne (1954) pointed out, is equivalent to the Roughrigg Bottom seam. This particular coal horizon occurs near the base of the Rosewood seams.

Although the Rosewood seams have not been worked in the New Malabar mine area east of the Malabar fault, they have been prospected by a trial shaft (A) in the south-west corner of sub. 6, portion 405, Parish of Walloon, and have also been tested in boreholes N.S. 12 and N.S. 14 drilled during 1953. In all cases, workable sections are confined to the bottom part of the succession. This coal, however, appears to be of commercial interest only in the western part of the area around boreholes N.S. 12 and N.S. 14 where there is a sufficient thickness of Jurassic cover beneath the Tertiary beds. Detailed seam sections with analytical results are shown in fig. 4.

The **New Malabar seam** (or Big seam) lies approximately 100 ft. below the Rosewood seams, the intervening strata being predominantly sandstone with a persistent, thin coal seam towards the base. A waxy, fawn shale band, 8 in.-2 ft. thick and locally called "bentonite," is always associated with this coaly horizon and so proves a very useful marker bed for correlation purposes. Recently this "bentonite" has been mined in the area covered by M.L. (Application) No. 514, access being gained through New Malabar No. 1 tunnel. The marketed product is being used for foundry purposes.

The behaviour of the New Malabar seam to the east of the Malabar fault has been fully described by Hawthorne (1954), the outstanding feature being the growth eastwards of a median grey shale band to as much as 3 ft. 9 in. As a result of the 1960 drilling campaign, this splitting of the New Malabar seam was proved to become more pronounced to the south-east, there being 6-8 ft. of shale and fine sandstone between the "tops" and "bottoms" of the seam in most boreholes. Furthermore, the "bottoms" of the seam are not as attractive in this area due to the growth of a persistent grey shale band (approximately 18 in. from the floor) from a few inches to over 1 ft. Variation in the New Malabar seam as penetrated in boreholes N.S. 10-14 and N.S. 186-193 is shown in fig. 6. Detailed logs of workable sections together with analytical results are set out in fig. 5.

No information is available about the New Malabar seam immediately to the west of the Malabar fault. In Malabar No. 6 Colliery just to the east of the fault, however, the shale between the "tops" and "bottoms" of the seam is reported to have been only 6 in. thick, the overall thickness of the seam being almost 6 ft. In 1956, a percussion borehole was put down by the colliery management about 5½ chains to the north-west of Malabar No. 3 tunnel, the depth of hole being 158 ft. Coal was reported from 109-113 ft., 133-135 ft., and 144-147 ft., but,

FIG. 5

NEW MALABAR

DIAGRAMS OF NEW MALABAR SEAM DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 186

Prox. Analysis, etc.	
M I	6·4
VM I	36·4
FC I	37·2
A I	20·0
BTU/lb.	10530
Joules/gm.	24480
S I	0·47
SG.	1·402
Coking tests:	
Class.	Af
Sw. Ind.	1

Recovery percent: 89·2

Section Sampled: Excl. / Excl.

	Description
242'6½"	7" dk gy sh. – carb sh.;
	14"(p bkn) coal w ¾" carb.sh at 9¼";
	3½" l gy sh;
	5½"(bkn) coal;
245'9¾"	10"(p b) coal w. 1¼" carb.sh. in mid;
	½" carb.sh;
	6'7½" i'b'd. l.gy.sh. & l gy.sa..

N.S. 188

Prox. Analysis etc.	
M I	7·2
VM I	37·2
FC I	41·9
A I	13·7
BTU/lb.	11,400
S	0·51
S.G.	1·352
Coking tests:	
Class.	Af
Sw. Ind.	1

Recovery percent: 98·0

Section Sampled: Excl / Excl

	Description
	2'7½" gy sh; 1" carb. sh;
204'4"	1" inf. coal, 1¼"(bkn) coal & carb. sh;
204'8½"	2" carb. sh. w. coal lam. in middle;
	1'6½" coal (bkn in btm. 1") w ¼" carb. sh. at 9¾";
	¼" carb. sh;
	7" gy. sh. w i carb. nods. in top 3";
	¼" carb. sh., 2" coal; 1" carb. sh.; 1'(b) inf. coal,
	11"(v bkn) coal;
	1"(p b) dk gy sh;
208'9"	5½"(v b) coal w 1" carb. sh. w ¼" fn. sh. in m., at 2";
	1' dk gy sh; ¾" carb. sh.; 2" dk gy. sh.;
	5'1" gy sh.

N.S. 190

Prox. Analysis, etc.			
M I	5·8	6·4	6·1
VM I	37·3	38·2	35·3
FC I	36·7	41·8	37·2
A I	20·2	13·6	21·4
BTU/lb.	10650	11560	10270
S I	0·54	0·49	0·44
S.G.	1·397	1·351	1·419
Coking tests:			
Class.	Af/Cw	Af/Cw	Af
Sw. Ind.	1	1	1

Recovery percent: 81·1 / 100 / 80·4

Section Sampled: Excl / Excl / Excl

	Description
	1'4" i'b'd. l gy. sh. & l gy. slts;
	¼" carb. sh., 2¾" coal;
166'7½"	1¾" fn. sh., 1" carb. sh.;
	3¾"(b) coal; 1" carb. sh;
	3"(b) coal; 1¾" gy. sh.;
	5½"(b) coal;
168'7¾"	1" gy sh; 3¾"(b) coal;
169'1¾"	6½" dk gy sh. – carb. sh. in btm. 1";
	2'1" coal – inf. coal in pl., w. sh. lam. at 1¾" & 7", & ¼" carb. sh. at 6½";
171'2¾"	9" i'b'd l gy sh & l gy. slts;
	5½" l gy sh;
172'5¾"	½" dk gy sh; ¼" coal; ¾" carb. sh;
	2¾" coal, slightly inf; ½" dk gy. sh;
	6½"(b) coal;
173'6½"	4" gy. sh. w. l carb. nod;
	2½" carb. sh; 1"(p b) coal
	8" l gy. sh.

N.S. 10

Prox. Analysis etc.		
M.I	4·7	5·6
VM I	35·8	38·2
FC I	37·7	42·4
A I	21·8	13·8
BTU/lb	10450	11630
S I	0·50	0·48
S G	1·433	1·355
Sw Ind.	1	1

Recovery percent: 100 / 100

Section Sampled: Excl / Excl

	Description
315'4"	1'7⅛" l gy sh;
	6½" coal, top 1" inf;
	1" carb. sh; 5¾" coal;
	¾" dk gy sh;
317'2½"	8½" coal;
	6¾" carb. sh;
	6"(bkn) coal;
	1'0½" l gy. sh;
319'3¾"	
	1'8" coal;
	¼" carb sh;
	1'6" coal;
322'6"	
	½" carb. sh;
	1½" l gy sh.

N.S. 12

Prox. Analysis, etc.		
M I	5·0	5·0
VM I	39·0	38·4
FC I	38·0	40·1
A I	18·0	16·5
BTU/lb.	11160	11290
Joules/gm.	25940	26230
S I	0·63	0·53
SG.	1·382	1·375
Sw. Ind.	1	1

Recovery percent: 100 / 85·7

Section Sampled: Excl / Excl / Excl / Excl

	Description
	9" l gy f sa.;
	2" gy. sh;
378'0½"	5" coaly sh. & inf. coal;
	1" dk gy. sh.; 1" fn. sh.;
	1'1" coal,
379'8½"	1" blk. sh.; 3" dk. gy – blk. sh;
	3" br – fn. sh;
	5" dk gy – blk. sh.;
	1" fn. sh.; 2½" blk. sh;
	8½" gy. sh;
381'10½"	2" carb. sh. – coal;
	1'0" coal,
	½" coaly sh, 1½" coal; 2" coaly sh.;
	9" coal;
	3½" gy sh;
	3" coal; 3" coaly. sh;
	5" coal;
	2½" inf. coal;
	3" coaly sh;
386'8"	1" inf. coal; 1" coaly sh; 1" inf. coal;
	2'0" gy. sh.

N.S. 14

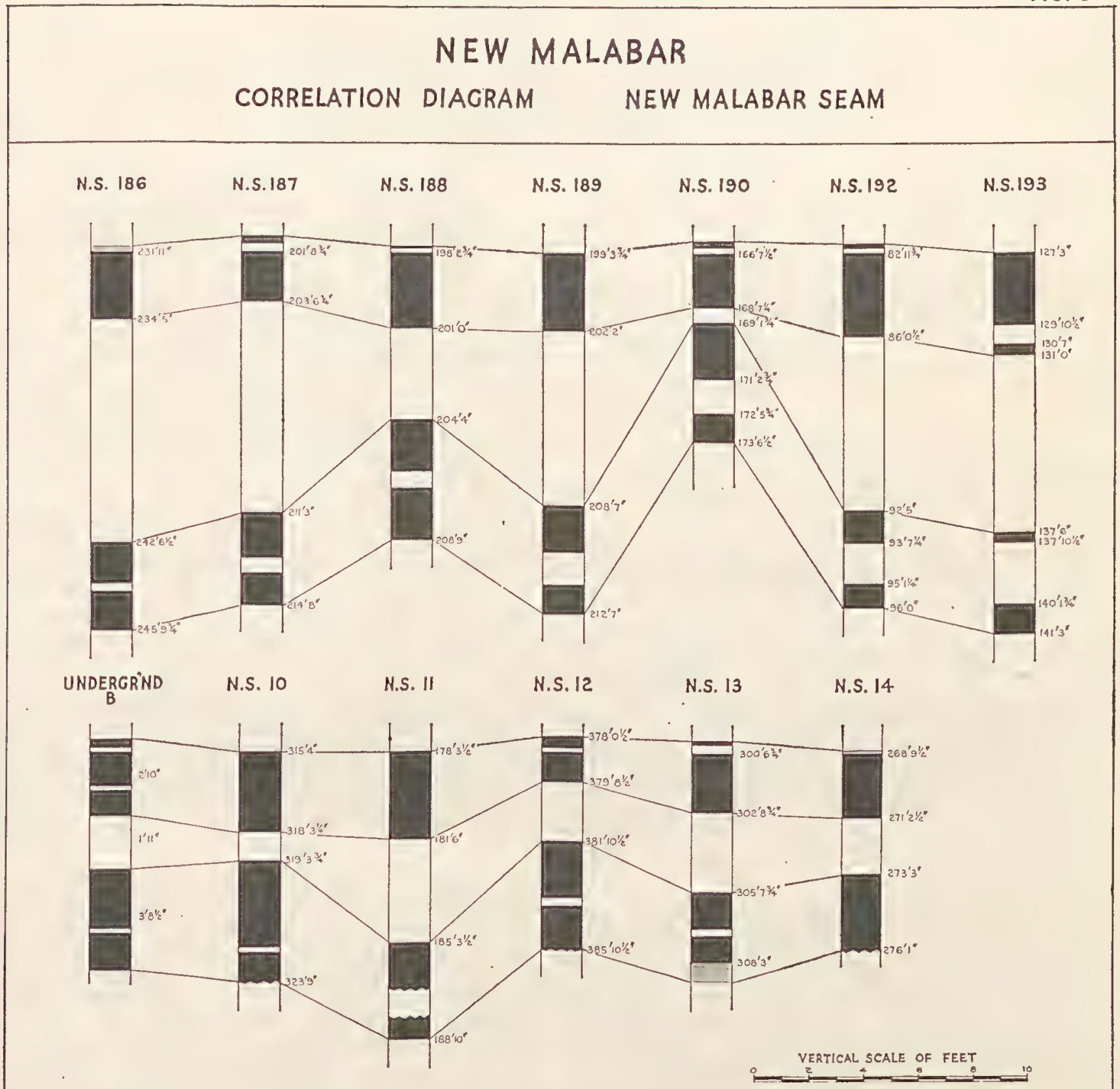
Prox. Analysis etc.		
M I	5·4	6·3
VM I	38·2	37·2
FC I	40·1	41·6
A I	16·3	14·9
BTU/lb	11250	11390
Joules/gm	26150	26480
S I	0·61	0·53
SG	1·376	1·360
Sw Ind.	1½	1½

Recovery percent: 100 / 100

Section Sampled: Excl / Excl.

	Description
	5' l gy sh;
268'9½"	1½" coaly sh;
	4" coal; 1½" gy. & coaly sh.;
	1'0" coal;
	3" coaly sh,
	4" coal; ½" gy sh.;
271'2½"	4" coal,
	1'0½" l gy.sh.;
	1½" carb. sh; 2" coal w ½" carb. sh. in mid,
	5" carb. sh.;
273'3"	2¾" l gy. sh; 1" carb. sh.;
	8"(bkn) coal;
	11⅝" coal,
	½" carb. sh; 2½" coal; 1" carb. sh.;
	5½" coal;
276'1½"	5" coal (bkn) some shaly
	6" carb sh;
	1" coal; 1" carb sh.;
	2'4" l gy sh.

FIG. 6

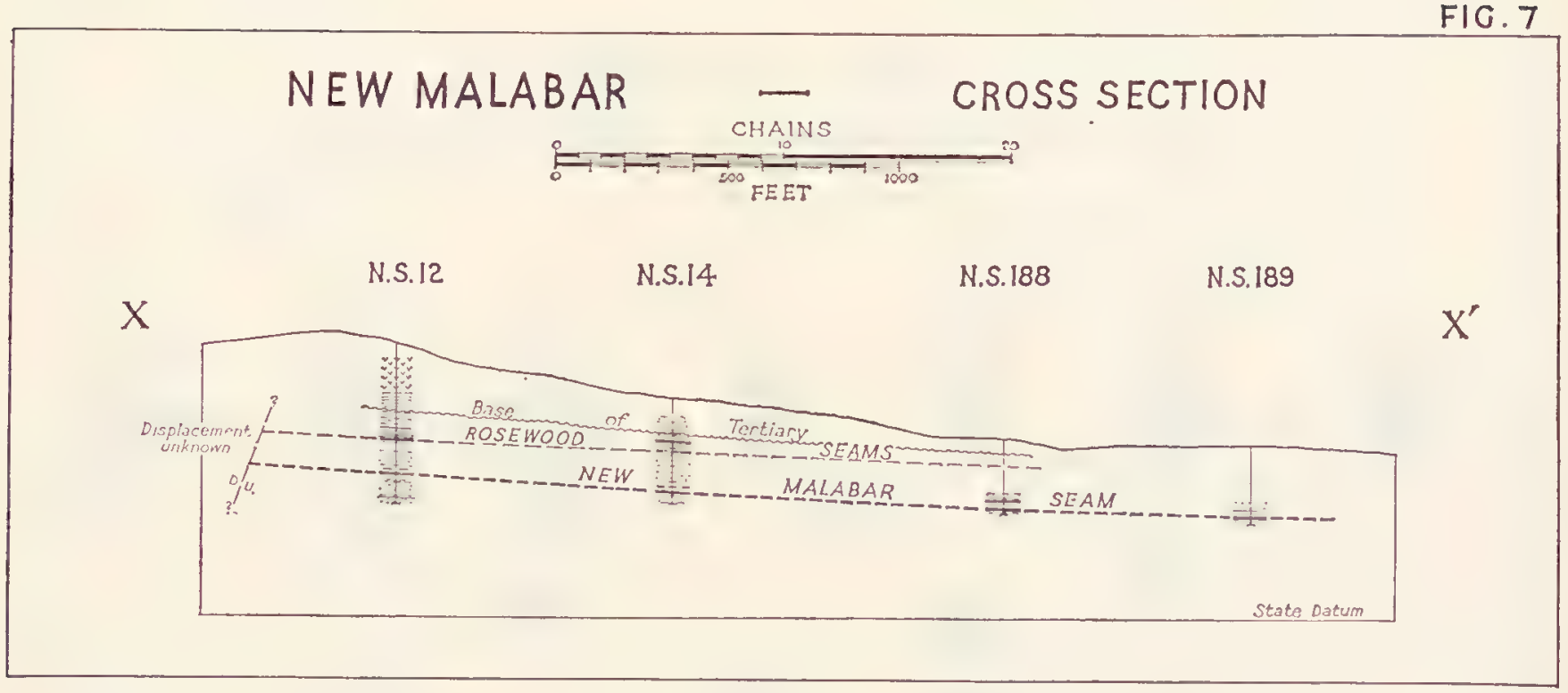


with the information available, correlation of the New Malabar seam with any of these coaly sections is not possible.

In boreholes N.S. 186 and N.S. 191 drilling was continued for 170-180 ft. below the New Malabar seam but none of the seams penetrated was of economic interest. This part of the succession can be readily correlated with the strata lying beneath the New Malabar seam in borehole N.S. 11 (see fig. 3). The lowest seam of any consequence in each of these three holes can be correlated on stratigraphic grounds with the **Lowfield seam** of the United No. 7 mine area (Cameron, 1963).

None of the boreholes drilled in 1960 was continued below the horizon of the Lowfield seam. In N.S. 11, however, drilled in 1953 to a depth of 655 ft. 6 in., thin coal plies were encountered for a further 155 ft. below the Lowfield seam. For 72 ft. below the last coal, that is, from 523 ft. 2 in. to 595 ft. 3½ in., the strata consist of fine sandstone, shale and siltstone of similar lithology to that of the overlying beds. Below 595 ft. 3½ in. thin beds of coarse pebbly sandstone occur interbedded with the usual Walloon-type rocks. This bottom 60 ft. of strata in borehole N.S. 11 is correlated with the **Marburg Sandstone** which outcrops a few miles to the north.

FIG. 7



STRUCTURAL GEOLOGY

The regional dip of the Walloon Coal Measures in the New Malabar mine area is approximately 2 degrees to the south-east. In the vicinity of boreholes N.S. 191-193, however, some local flattening in seam grades may occur for in those holes the New Malabar seam was penetrated some 20 ft. above the expected depth. This condition, of course, could result also from faulting, evidence of which was encountered below the New Malabar seam in boreholes N.S. 191 and 193. Faulting was also met with in borehole N.S. 186 approximately 90 ft. below the New Malabar seam but it is not expected to hinder mining operations.

The outstanding structural feature of the mine area is the Malabar fault to the west of the area drilled (Hawthorne, 1954). In 1955, this fault was penetrated in underground workings for the first time when a displacement of close on 100 ft. was proved, the western side being the downthrown side. The Malabar fault most likely extends to the south-east towards N.S. 12 but the displacement there is unknown.

COAL RESOURCES

In appraising seam sections cored by diamond drilling in the Rosewood Coalfield, the following criteria of workability have been employed:—a minimum thickness of 3ft.; a workable coal to stone ratio; and an ash content, after exclusion of stone bands normally removed in practice, of not more than 25 per cent. The status of the reserves established by the drilling programme depends on the distance between observation points (diamond drill holes or mine workings):—

(*a*) measured reserves—up to 12½ chains.

(*b*) indicated reserves—from 12½ to 20 chains.

The area of both measured and indicated reserves is defined as extending no more than 5 chains beyond the most outlying of those points of observation at which the seam section satisfies the three requirements of workability.

Since 1953, the **Rosewood seams** in the New Malabar mine area east of the Malabar fault have been exposed at only one additional point, the trial shaft (A) situated nearly 25 chains to the south-east of borehole N.S. 14. In consequence, there is still insufficient information to estimate any reserves in these seams.

Measured reserves in the **New Malabar seam** established by the first Departmental programme of diamond drilling were estimated at 550,000 tons (Hawthorne, 1954). At that time, access to this coal was readily available from the New Malabar No. 1 Colliery workings and it was considered that the complete section of the New Malabar seam could be profitably exploited as far east as boreholes N.S. 11 and N.S. 13 even though the "tops" and "bottoms" were separated by 3-4 ft. of stone at those points. This splitting becomes more pronounced to the south-east and if access to the New Malabar seam is to be gained from that part of the mine area, the working section must for a considerable period be confined to the "bottoms" of the seam. Under these conditions, it is unlikely that the complete section of the New Malabar seam around boreholes N.S. 11 and N.S. 13 will ever be worked and if the "tops" of the seam are worked at all, it will be only in the western part of the area drilled in the vicinity of boreholes N.S. 10, N.S. 12, N.S. 14, and N.S. 190, where the split is 6 in.–2 ft. 2 in. thick. In view of these changed circumstances, a fresh appraisal of coal reserves in the New Malabar seam has been based on the results of both the 1953 and 1960 diamond drilling campaigns.

Because of the local topography and the occurrence of rather dense scrub in some parts of the mine area it was not always possible to maintain the usual 12½ chains between diamond drill holes and so only indicated reserves have been estimated for the **New Malabar seam.** These reserves extend over an area of 68 acres embracing boreholes N.S. 10, N.S. 12, N.S. 14, N.S. 186, N.S. 188, and N.S. 190. The working section which comprises only the "bottoms" of the seam ranges in thickness from 3 ft. 2¼ in. to 4 ft. 9½ in., the average thickness of coal being 3 ft. 2½ in. Indicated reserves, with a weighted average ash content of 15·8 per cent., total 365,000 tons. Although in the western part of the area defined, the "tops" of the new Malabar seam lie 6 in.–2 ft. 2 in. above the "bottoms", it is unlikely that this coal will ever be worked since its exploitation would entail different mining methods from those most likely to be used in working the "bottoms" alone. Consequently, no attempt has been made to calculate reserves in the "tops" of the New Malabar seam. Nevertheless, the improvement in the section of the New Malabar seam westwards is quite marked and it is possible that more attractive working sections exist in this seam to the west of the area drilled. In the northern part of the mine area this coal would be on the western side of the Malabar fault.

NATURE OF COAL

The New Malabar seam coal is of high volatile bituminous rank. Fixed carbon, calculated on a dry, mineral-matter free basis ranges from 52·0 to 53·8 per cent. Calorific value, calculated on a moist, mineral-matter-free basis ranges from 13,370 to 13,750 B.Th.U. per lb.

CONCLUSIONS

When New Malabar No. 1 Colliery was abandoned in 1954, considerable reserves of coal in the working seam were left unexploited. Access to this coal lying to the south of the mine is now possible only from the south-eastern slopes of the Perry's Knob feature but due to splitting of the New Malabar seam in this area only the "bottoms" of the seam can be worked. Indicated reserves in this section of the New Malabar seam within the area tested by diamond drilling total 365,000 tons, the weighted average ash content being 15·8 per cent. Because of the conditions now obtaining, it is considered that some of the borehole intersections (N.S. 11 and N.S. 13) previously included in the area of measured reserves (Hawthorne, 1954) cannot now be profitably worked. Consequently, the present estimate is somewhat less than the 550,000 tons previously calculated.

REFERENCES

CAMERON, J. B., 1963: Coal resources, Rosewood-Walloon coalfield (United No. 7 mine area). *Geol. Surv. Qld Pbl.*, 310, 9-15.

DE JERSEY, N. J., 1955*a*: Spore distribution and correlation Rosewood coalfield Part 1.—Roughrigg and Malabar mine areas. *Qld Govt Min. J., 56,* 55-59.

————, (1955*b*): Coal sample from New Malabar No. 2 colliery. Unpub. rep. Geol. Surv. Qld.

HAWTHORNE, W. L., 1954: Coal resources—Rosewood-Walloon coalfield (Malabar mine area). *Qld Govt Min. J., 55,* 225-232.

————, (1955): Interim report—Malabar colliery. Unpub. rep. Geol. Surv. Qld.

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272.*

5th May, 1961.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD
(CALEDONIAN No. 5 MINE AREA)

By E. S. CHIU CHONG

SUMMARY

During 1959-60, thirty-four holes, totalling, 5,981 ft 6 in., were drilled to establish reserves in the Caledonian No. 5 working seam and in the Top seam which overlies it at an interval of 45 to 70 ft.

The Caledonian No. 5 working seam consists of three coaly sections, separated by shale bands. The upper and middle sections, which are separated by a waxy, bentonitic shale, are correlated with the Lowfield seam worked elsewhere on the field. In the east, where the lower shale increases with thickness, only the upper two coal sections are worked. Westerly, the thickness of both upper coal and lower shale decrease and the lower two coal sections are exploited. In an area to the north, drilling has shown that the full section of the Caledonian No. 5 seam is workable in the eastern part, but in a westerly direction the bottom shale increases in thickness to more than 6 ft. so that only the upper and middle sections are of economic interest.

The Top seam, which is correlated with the Lanefield No. 5 seam, has been tested in an area partly overlying the workings and extending westerly. A workable section of the seam has been proved.

In an area to the south of Mt. Marrow, thin sills and dykes of basalt intrude the measures and in places coke the coals. Their effect, combined with minor faulting, may constitute an obstacle to entry into the western part of the leases.

Measured reserves have been established in the Lanefield No. 5 and Caledonian No. 5 seams. In an area of 70 acres, the Lanefield No. 5 "tops" have an average working section of 3 ft. 10½ in. carrying 3 ft. 4½ in. of coal. Coal tonnage amounts to 408,000 tons. To the west of the workings, reserves in the Caledonian No. 5 seam extend over an area of 34 acres, with average coal thickness of 4 ft. 3 in. in a working section of 5 ft. 7 in., and amount to 239,000 tons. In the northern area, the full section of the Caledonian No. 5 seam is workable over an area of 74 acres in the east, with coal thickness averaging 4 ft. 10 in. in a working thickness of 7 ft. 0 in. Reserves amount to 600,000 tons. Only the top and middle sections are workable over an area of 67 acres to the west. With average coal thickness of 3 ft. 5½ in. in a working thickness of 3 ft. 10½ in., coal reserves amount to 380,000 tons.

Summarised, measured reserves have been calculated as:—

	Tons
(*a*) *Lanefield No. 5 "tops"*	408,000
(*b*) *Caledonian No. 5 seam*	
(i) *Western sector*	239,000
(ii) *Northern sector—*	
East	600,000
West	380,000
Total	1,627,000

H. G. S. CRIBB,
Assistant Chief Government Geologist.

INTRODUCTION

Diamond drilling to the south and east of Mt. Marrow was undertaken from April to December, 1959, and in April, 1960, using the Department of Mines' Sullivan 22 H.D. No. 1 plant. The area drilled comprises Coal Mining Leases Nos. 332, 438, 460, and 510, held by Caledonian Collieries Pty. Ltd. Thirty-four holes, N.S. 153-184 and N.S. 194-195, were drilled, individual depths ranging from 90 ft. 1 in. (N.S. 169) to 515 ft. 0 in. (N.S. 153). Total footage drilled was 5,981 ft. 6 in., of which 3,302 ft. 5 in. was cored. An overall core recovery of 92.6 per cent. was obtained. Because of poor recovery in coal seams, N.S. 156 and N.S. 159 were drilled at the sites of N.S. 155 and N.S. 158 respectively, while N.S. 194 was drilled approximately midway between N.S. 153 and N.S. 155-6. Because of difficulty in penetrating Tertiary basalt at the site of N.S. 182-3, N.S. 184 was drilled about two chains to the east.

This report is accompanied by the following plans and diagrams:—

(i) Locality Map—fig. 1.

(ii) Plan showing position of boreholes, extent of mine workings, surface contours at 10 ft. intervals and underground levels on State Datum, and boundaries of measured reserves—fig. 2.

(iii) Generalised bore sections—figs. 3 (*a*) and (*b*).

(iv) Diagram showing details of seam sections analysed, together with results—

(*a*) Top seam—fig. 4 (*a*).

(*b*) Caledonian No. 5 working seam—

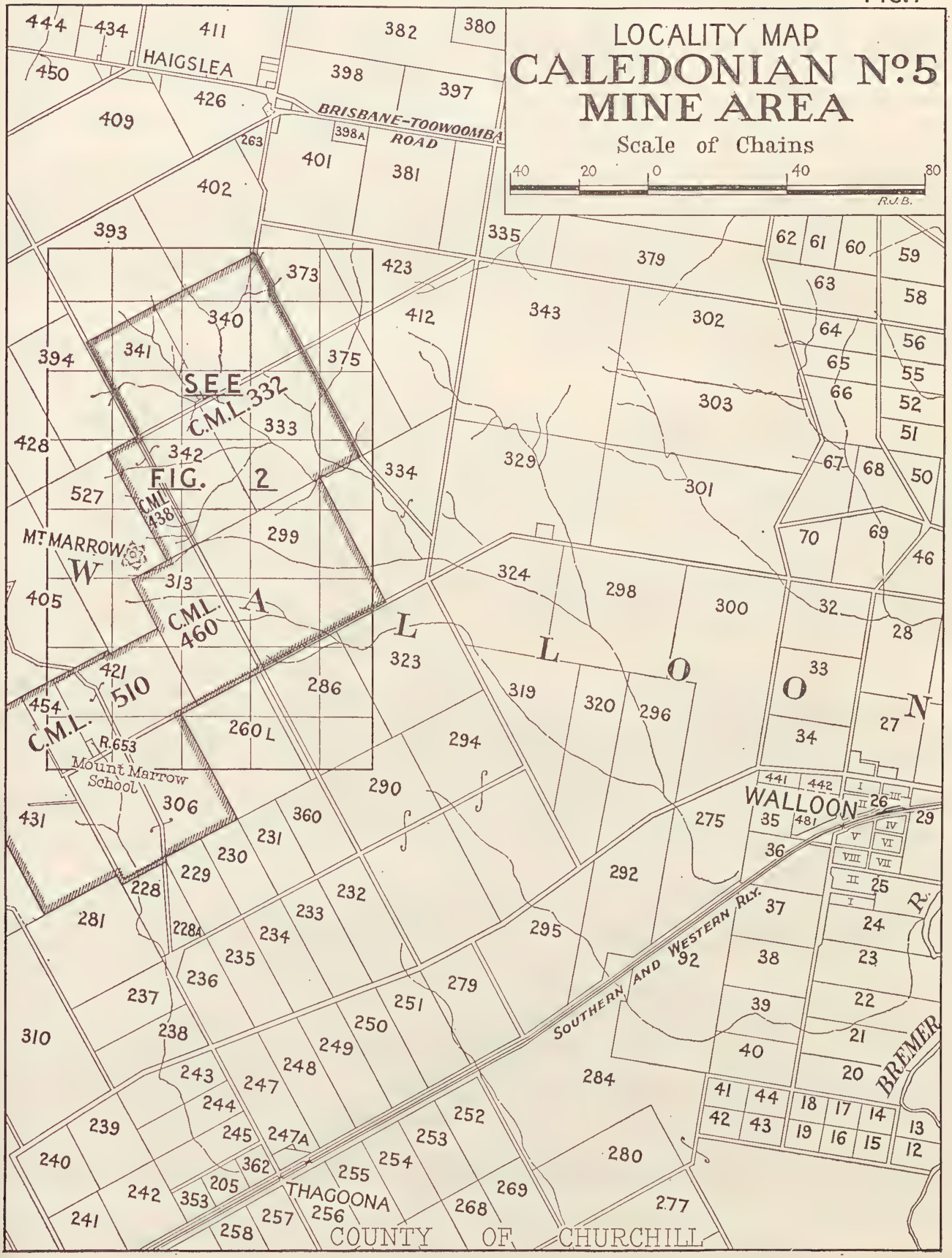
(1) Western sector—fig. 4 (*b*).

(2) Northern sector—figs. 4 (*c*) and 4 (*d*).

(v) Cross-sections—fig. 5.

All workable coal sections encountered during the drilling programme were examined by an Engineer Member of the Queensland Coal Board. The sampling of these sections was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone both underground and on the surface. All analyses were carried out by the Government Analyst. Seam correlation is based on geological work undertaken by H. G. S. Cribb in 1948, W. L. Hawthorne in 1954, J. B. Cameron since 1956 and the writer since 1959.

FIG. 1


LOCALITY MAP
CALEDONIAN No.5
MINE AREA
Scale of Chains
40 20 0 40 80
R.J.B.
HAIGSLEA
BRISBANE-TOOWOOMBA ROAD
SEE C.M.L. 332
FIG. 2
C.M.L. 438
C.M.L. 460
C.M.L. 454
R.653
Mount Marrow School
Mt MARROW
WALLOON
BREMER
SOUTHERN AND WESTERN RLY.
THAGOONA
COUNTY OF CHURCHILL

MINE WORKINGS

Caledonian No. 5 Colliery lies approximately 2½ miles north-west of Walloon Railway Station. This area was first worked from the Caledonian No. 4 Colliery, which lies some 25 chains to the north-north-east of the present working tunnel, and was commenced in 1938. The No. 4 Colliery was abandoned in 1951, because of excessive water seepage from the overlying strata.

The Caledonian No. 5 working seam is divisible into three sections of coal separated by shale bands. Workings to the east exploit the upper two coal bands—a section equivalent to that worked in the No. 4 Colliery. The light grey shale band separating the lower two coal bands is too thick to permit the bottom coal to be worked economically in this sector. Towards the west, the thickness of both the top coal and the lower shale decrease, so that the lower two coaly sections are workable.

GENERAL GEOLOGY

With the exception of the Tertiary basalt-capped Mt. Marrow, standing some 600 ft. above the surrounding country, the surface around Caledonian No. 5 mine area is undulating. Basalt is also found on most of the hillocks in the area. This basalt has been quarried in several places.

Lying unconformably beneath this basalt are the Walloon Coal Measures of Jurassic age. Because of the high clay content in these sediments, weathering is advanced, and rock outcrops are rare.

SUBSURFACE GEOLOGY

Of the 34 holes drilled in the area, 15 of them, N.S. 164-178, were drilled to the north of present mine workings. Their objective was the working seam. The remaining 19 holes, N.S. 153-163, N.S. 179-184, and N.S. 194-195, were drilled over, or to the west of, present workings. The objective of N.S. 158-163 was a seam some 45-70 ft. stratigraphically higher than the one at present being worked. Both seams were cored in the remaining holes.

Tertiary basalt occurs at the top of the stratigraphic sequence in this area. Sludge samples taken from N.S. 154 show that there is approximately 80 ft. of basalt in that hole.

The Walloon Coal Measures are composed of argillaceous sandstones, siltstones and shales, with several coal seams. The coaly horizon encountered at 70 ft. 6 in. in N.S. 181 is considered, by lithological and stratigraphical reasoning, to be equivalent to the **New Malabar seam** (Hawthorne, 1954). It has been removed by erosion over most of the area.

The highest workable coal seam, situated some 60 ft. stratigraphically below the New Malabar seam, was met at 88 ft. in N.S. 161. The topmost coal ply in this **Top seam,** 5 in. to 2 ft. 4 in. thick, is split off from the rest of the seam by up to 7 ft. of shale. It has presumably been contemporaneously eroded by the sandstone lying directly above the remainder of the seam in N.S. 155-6, N.S. 163-164 and N.S. 180. A basaltic sill occurs as the roof of this coal in N.S. 154. The remainder of the seam is divisible into the "tops" and the "bottoms." The "tops" contain over 3 ft. of coal with several thin shale bands. It is split from the "bottoms," approximately 12 in. thick, by a light grey shale of varying thickness—7 in. in N.S. 153 to 6 ft. 2 in. in N.S. 161. Because of thickening of this band in all directions from N.S. 153, the "bottoms" cannot be economically worked. However, an area containing a workable section of "tops" was proved by the drilling. Where the thickness between the "top coal" and the "tops," or between the "tops" and the "bottoms" was small, the relevant sections were also analysed (see fig. 4 (*a*)).

To the west of this area of reserves, the quality of the coal deteriorates, while in N.S. 181 and N.S. 184, the seam is affected by basaltic sills. To the north, not only has the quality of the coal deteriorated, but thickening of the shale bands and thinning of the coal plies have also taken place. In N.S. 157, the seam occurred at a higher level than was expected. This difference in levels can be satisfactorily explained by slight variations in the dip of the strata, and by faulting, the severeness of which is exhibited in N.S. 179 around the horizon of this seam. The Top seam is correlated with the **Lanefield No. 5 seam** (Cameron, 1956*a*).

Varying from 45 to 70 ft. below the Top seam lies the Caledonian No. 5 seam. From 3 to 23 ft. above this working seam occurs a 4 to 7 ft. coaly section, which is very variable in both thickness and quality. It is characterised by the presence of several waxy shale bands. Although workable sections were cored in some holes, it was found that, because of its tendency to vary within a very short distance, no area of reserves could be established.

The **Caledonian No. 5 seam** may be divided into three sections of coal. The top and middle coals are separated by a waxy, bentonitic shale, while a light grey shale divides the middle and bottom sections. The top coal increases from a few inches in the west to over two feet in the east, where the lower foot or so deteriorates into a blocky carbonaceous shale. The middle coal, having an average thickness of just under 3 ft., contains a hard fawn shale, up to 2 in. thick, several inches from the base. The lower portion of this coal is beginning to deteriorate in the western sector of the present mine workings. This deterioration is relatively extensive as equivalent sections in the western boreholes show the presence of almost a foot of blocky carbonaceous shale in this position. The bottom coal ply, 2 to 5 ft. thick, is split by three persistent shale bands of varying thicknesses. It is separated from the remainder of the working seam by a light grey shale varying from 1½ in. in the west to over 6 ft. in the north and east. In the most northerly boreholes it has decreased again to under 6 in. In the east where this shale band is relatively thick,

FIG. 2

— SURVEY DATA —

Elevations in feet on State Datum

Grid of 20 chain coordinates

Meridian of grid is True North at point of origin — Perry's Knob Trig. Station.

Surveyed and drawn by Ewan Cowley, Surveyor

Drawn for publication at the Department of Mines, Brisbane by T.M. Lisle

— LEGEND —

- Measured reserves on Caledonian No.5 Seam
- Measured reserves on Lanefield No.5 Seam
- Working Colliery — NOB
- Abandoned Colliery — NOB A
- Underground workings
- Mine sample — A
- Section line — A — A'
- Diamond drillhole — N.S.171
- Shaft
- Fault
- Surface contours — 140, 120

N.S.175 R.L.Coll. 393·61 R.L.Surf. 391·14

N.S.178 R.L.Coll. 361·19 R.L.Surf. 359·52

N.S.176 R.L.Coll. 384·86 R.L.Surf. 383·61

N.S.171 R.L.Coll. 359·32 R.L.Surf. 357·82

N.S.172 R.L.Coll. 400·82 R.L.Surf. 399·15

N.S.177 R.L.Coll. 401·17 R.L.Surf. 399·50

N.S.173 R.L.Coll. 341·90 R.L.Surf. 340·57

N.S.168 R.L.Coll. 353·27 R.L.Surf. 352·02

N.S.170 R.L.Coll. 353·18 R.L.Surf. 352·10

N.S.174 R.L.Coll. 332·84 R.L.Surf. 331·67

N.S.169 R.L.Coll. 301·78 R.L.Surf. 300·61

N.S.166 R.L.Coll. 312·64 R.L.Surf. 311·47

N.S.167 R.L.Coll. 358·72 R.L.Surf. 351·47

N.S.165 R.L.Coll. 347·81 R.L.Surf. 346·31

N.S.164 R.L.Coll. 438·89 R.L.Surf. 437·22

CALEDONIAN A No.4

Plan of
CALEDONIAN No.5 MINE AREA
ROSEWOOD — WALLOON COALFIELD
Parish of Walloon

County of Churchill

To accompany a report by E.S. Chiu Chong, B.Sc., Geologist

Scale of Chains

10 0 10 20

N.S.163 R.L.Coll. 410·68 R.L.Surf. 409·33

N.S.162 R.L.Coll. 387·67 R.L.Surf. 386·17

CALEDONIAN No.5

N.S.160 R.L.Coll. 415·33 R.L.Surf. 413·50

N.S.161 R.L.Coll. 335·92 R.L.Surf. 334·75

N.S.154 R.L.Coll. 450·48 R.L.Surf. 449·31

N.S.159 R.L.Coll. 371·58 R.L.Surf. 370·25

N.S.158 R.L.Coll. 371·58 R.L.Surf. 370·25

EVAN'S TNL. A

N.S.157 R.L.Coll. 337·04 R.L.Surf. 336·71

N.S.184 R.L.Coll. 444·37 R.L.Surf. 441·37

N.S.182/3 R.L.Coll. 475·44 R.L.Surf. 473·18

N.S.153 R.L.Coll. 370·40 R.L.Surf. 369·15

N.S.194 R.L.Coll. 347·36 R.L.Surf. 346·11

N.S.156 R.L.Coll. 335·15 R.L.Surf. 333·15

N.S.155 R.L.Coll. 334·40 R.L.Surf. 332·15

N.S.181 R.L.Coll. 375·50 R.L.Surf. 374·17

N.S.179 R.L.Coll. 312·65 R.L.Surf. 311·07

N.S.180 R.L.Coll. 322·47 R.L.Surf. 320·72

N.S.195 R.L.Coll. 342·28 R.L.Surf. 340·70

TRACE ON LOWFIELD 5.

Mt. Marrow School

NORMANTON No.2 A

Vacant Land

16000 N, 14000 N, 12000 N, 10000 N, 8000 N, 6000 N, 4000 N

10000 E, 12000 E, 14000 E, 16000 E, 18000 E

FIG. 3A

CALEDONIAN No. 5 GENERALISED BORE SECTIONS

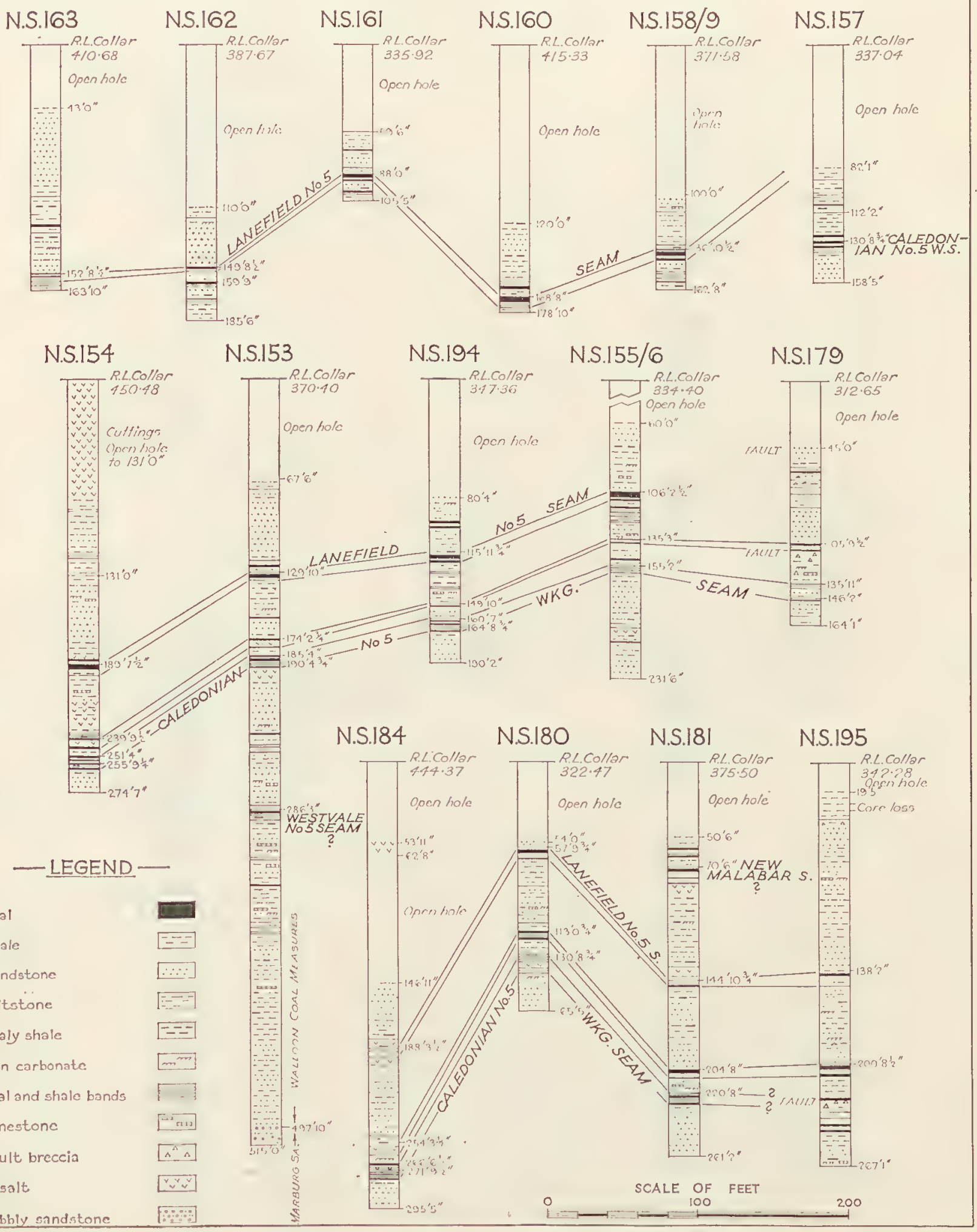


FIG. 3B

CALEDONIAN No.5 GENERALISED BORE SECTIONS

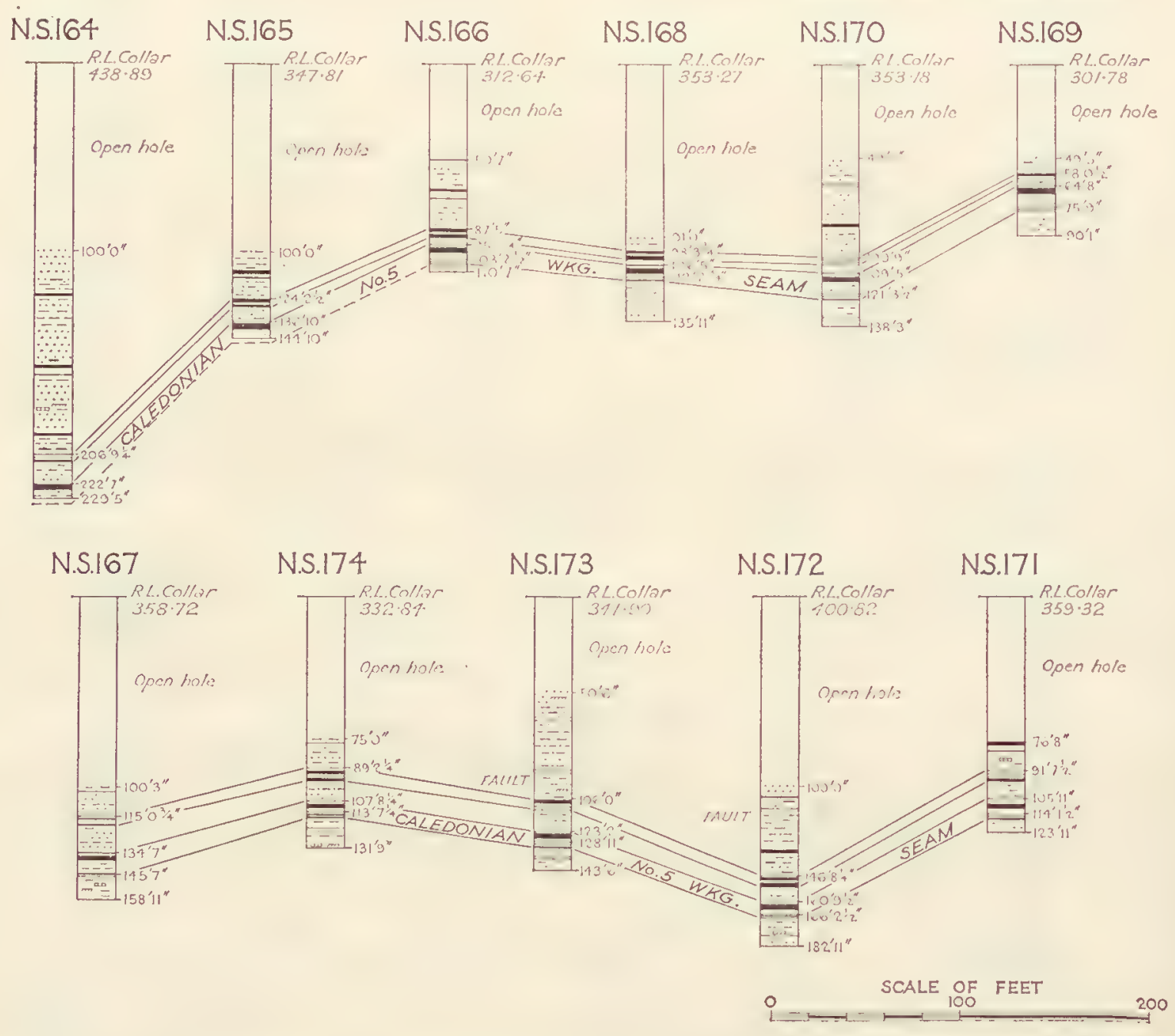
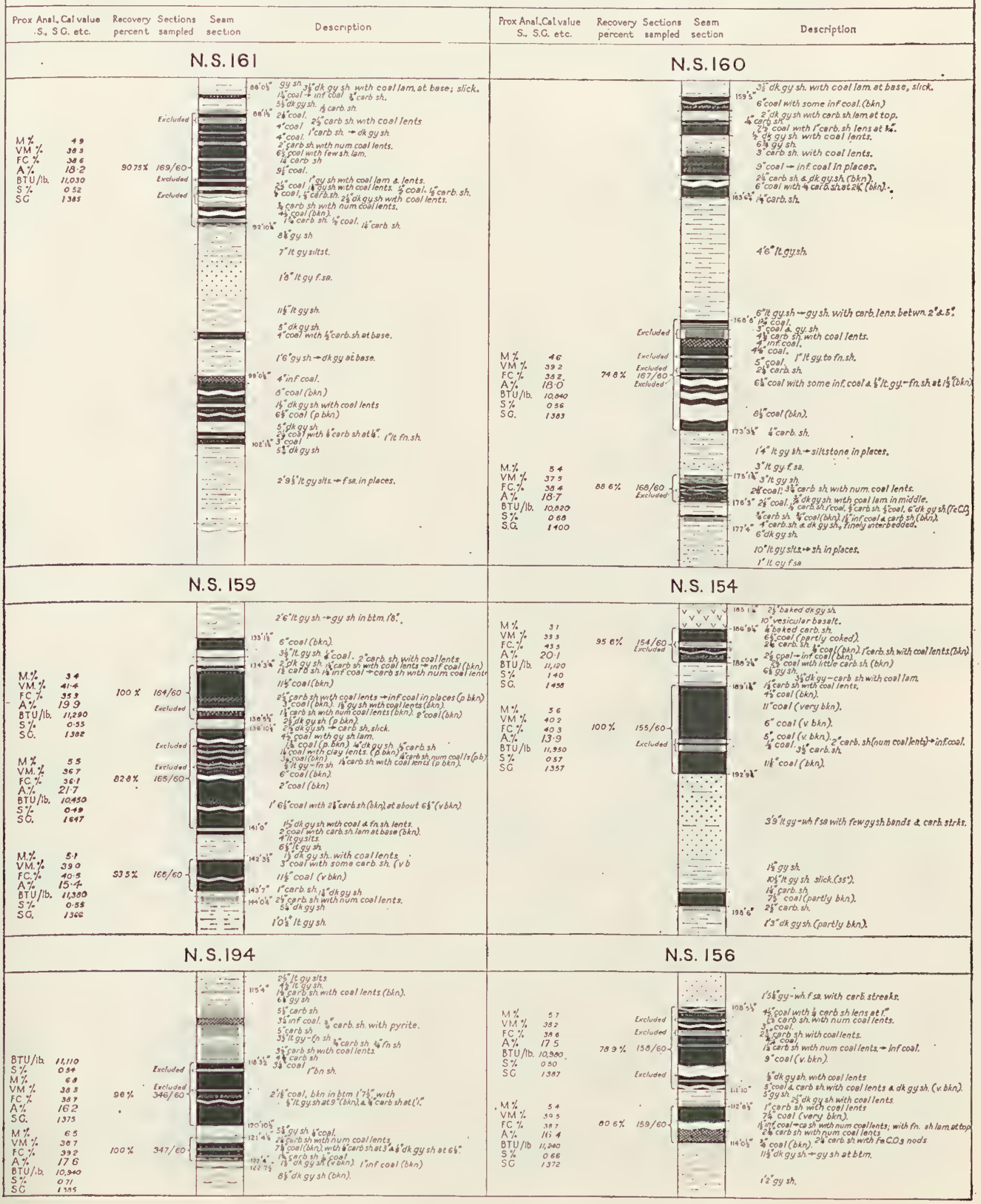


FIG. 4A

CALEDONIAN No.5

DIAGRAMS OF LANEFIELD No.5 SEAM

DETAILS OF CORE RECOVERY AND ANALYSIS


Prox Anal., Cal value S., S.G. etc.
Recovery percent
Sections sampled
Seam section
Description
N.S. 161
M % 4·9
VM % 36·3
FC % 34·6
A % 18·2
BTU/lb. 11,030
S % 0·52
SG 1·385
90·75% 169/60
Excluded
Excluded
Excluded
86'0½" gy sh
3½" dk gy sh with coal lam at base; slick.
1¼" coal → inf coal
⅜" carb sh.
5½" dk gy sh.
¼ carb sh.
86'1½" 2½" coal.
4" coal
2½" carb sh with coal lents
4" coal.
1" carb sh → dk gy sh
2" carb sh with num coal lents.
6½" coal with few sh lam.
¼" carb sh
9½" coal.
2½" coal
1" gy sh with coal lam & lents.
¼ coal, ½ carb sh. 2⅛" dk gy sh with coal lents.
⅜ carb sh with num coal lents.
4½" coal (bkn).
92'10½" 1¼" carb sh. ½" coal. ¼" carb sh.
8⅛" gy sh
7" lt gy siltst.
1'8" lt gy f.sa.
11½" lt gy sh.
5" dk gy sh.
4" coal with ½" carb sh at base.
1'6" gy sh → dk gy at base.
99'0½" 4" inf coal.
6" coal (bkn)
1½" dk gy sh with coal lents
6⅝" coal (p bkn)
5" dk gy sh.
2½ coal with ⅛" carb sh at ½". 1" lt fn sh.
102'1½" 3" coal
5½" dk gy sh
2'9½" lt gy slts. → f sa. in places.
N.S. 160
M % 4·6
VM % 39·2
FC % 38·2
A % 18·0
BTU/lb. 10,640
S % 0·56
SG 1·383
74·8% 167/60
Excluded
Excluded
Excluded
Excluded
M % 5·4
VM % 37·5
FC % 38·4
A % 18·7
BTU/lb. 10,820
S % 0·68
S.G. 1·400
88·6% 168/60
Excluded
159'5" 3½" dk gy sh with coal lam at base, slick.
6" coal with some inf coal. (bkn.)
2" dk gy sh with carb sh lam at top.
¼" carb sh
2½ coal with 1" carb. sh lens at ½".
½ dk gy sh with coal lents.
6¾ gy sh.
3" carb sh. with coal lents.
9" coal → inf. coal in places.
2½" carb sh & dk gy sh. (bkn).
6" coal with ¼ carb sh at 2¼" (bkn).
163'6¼" ¼" carb. sh.
4'6" lt. gy. sh.
166'6" 6" lt gy sh → gy sh. with carb. lens. betwn. 2" & 5".
1½ coal.
3" coal & gy. sh.
4½ carb sh with coal lents.
4" inf. coal.
4½" coal. 1" lt gy to fn. sh.
5" coal.
2½" carb. sh.
6¼" coal with some inf. coal & ½" lt. gy. - fn. sh at 1½" (bkn).
8½" coal (bkn).
173'3½" ¼" carb. sh.
1'4" lt gy sh. → siltstone in places.
3" lt gy f. sa.
175'1⅛" 3" lt gy sh.
2½" coal. 3¾" carb. sh with num. coal lents.
176'3" 2½" coal. ⅜ dk gy sh with coal lam in middle.
½ carb sh. ½" coal, ¼ carb sh. ½ coal, 6" dk gy sh. (FeCO3
⅜ carb sh. ¾" coal (bkn). 1½" inf. coal & carb sh (bkn).
177'¼" 4" carb. sh. & dk gy sh, finely interbedded.
6" dk gy sh.
10" lt gy slts. → sh. in places.
1" lt gy f. sa.
N.S. 159
M % 3·4
VM % 41·4
FC % 35·3
A % 19·9
BTU/lb. 11,290
S % 0·55
SG 1·382
100 % 164/60
Excluded
M % 5·5
VM % 36·7
FC % 36·1
A % 21·7
BTU/lb. 10,450
S % 0·49
SG 1·647
82·8% 165/60
M % 5·1
VM % 39·0
FC % 40·5
A % 15·4
BTU/lb. 11,380
S % 0·55
SG 1·366
93·5% 166/60
Excluded
Excluded
Excluded
2'6" lt gy sh. → gy sh in btm. 1'8".
135'1⅛" 6" coal (bkn).
3½" lt gy sh ¼ coal. 2" carb. sh with coal lents.
134'3¼" 2" dk gy sh. ½ carb sh with coal lents → inf coal (bkn)
1⅛ carb sh. ½ inf coal → carb sh with num coal lents
11½" coal (bkn)
2½" carb sh with coal lents → inf coal in places (p bkn)
3" coal (bkn). 1⅛" gy sh with coal lents (bkn).
1½ carb sh with num coal lents (bkn). 2" coal (bkn)
136'5½" 2½ dk gy sh (p bkn).
136'10¼" 2½ dk gy sh → carb sh, slick.
4½" coal with gy sh lam.
1½ coal (p. bkn). ¼" dk gy sh. ½" carb. sh
1½ coal with clay lents. (p bkn). ¼" carb sh, num coal lts (pb
⅜ coal (bkn) ¼" carb sh with coal lents (p bkn).
½ lt gy - fn sh. ½ carb sh with coal lents (p bkn).
6" coal (bkn).
2" coal (bkn)
1' 6½" coal with 2½" carb sh (bkn) at about 6½" (v bkn).
141'0" 1½" dk gy sh with coal & fn sh lents.
2" coal with carb sh lam at base (bkn).
4" lt gy slts.
6½" lt gy sh.
142'3½" 1½ dk gy sh.. with coal lents.
3" coal with some carb. sh. (v b
11½" coal (v bkn)
143'7" 1" carb. sh. 1⅛" dk gy sh
144'0¼" 2½" carb. sh with num coal lents.
5¾ dk gy sh
1'0½" lt gy sh.
N.S. 154
M % 3·1
VM % 33·3
FC % 43·5
A % 20·1
BTU/lb. 11,120
S % 1·40
SG 1·458
95·6% 154/60
Excluded
M % 5·6
VM % 40·2
FC % 40·3
A % 13·9
BTU/lb 11,950
S % 0·57
SG 1·357
100 % 155/60
Excluded
185'1½" 2½" baked dk gy sh.
10" vesicular basalt.
186'9¼" ¼ baked carb. sh.
6¼ coal (partly coked).
2⅛ carb. sh. ½ coal (bkn). 1" carb. sh with coal lents (bkn)
188'2¼" 2½ coal → inf coal (bkn).
2½ coal with little carb sh. (bkn)
6½ gy sh.
3½" dk gy - carb sh with coal lam.
189'1¾" 1½" carb sh with coal lents.
4½" coal (bkn).
11" coal (very bkn).
6" coal (v bkn).
5" coal (v bkn). 2" carb. sh (num coal lents) → inf. coal.
¼ coal. 3½" carb. sh.
1¼" coal (bkn).
192'9½"
3'9" lt gy - wh f sa with few gy sh bands & carb strks.
1¼ gy sh.
10½" lt gy sh slick. (35°).
1¼" carb. sh.
7½ coal (partly bkn).
198'6" 2½" carb. sh.
1'3" dk gy sh. (partly bkn).
N.S. 194
BTU/lb. 11,110
S % 0·54
M % 6·6
VM % 38·3
FC % 38·7
A % 16·2
SG. 1·375
Excluded
Excluded
98 %
M % 6·5
VM % 38·7
FC % 39·2
A % 17·6
BTU/lb. 10,940
S % 0·71
SG 1·385
346/60
100 %
347/60
115'4" 2½" lt gy slts.
1½" lt gy sh.
1½ carb sh with coal lents (bkn).
6¼ gy sh
5½" carb sh.
3¼ inf coal. ⅜" carb. sh. with pyrite.
5" carb sh
3½ lt gy - fn sh ⅜ carb sh. ½ fn sh
3½" carb sh with coal lents.
118'3½" 4¼ carb sh
3¼ coal 1" bn sh.
2'1⅝" coal, bkn in btm 1'7½" with
½ lt gy sh at 9" (bkn), & ¼ carb sh at 1".
120'10½" 5¾ gy sh ½ coal.
121'4½" 2½ carb sh with num coal lents.
7⅜ coal (bkn), with ½ carb sh at 3" & ½ dk gy sh at 6½".
122'4" 1½ carb sh ½ coal
122'7½" 1⅛ dk gy sh (v bkn). 1" inf coal (bkn)
8½" dk gy sh (bkn).
N.S. 156
M % 5·7
VM % 38·2
FC % 38·6
A % 17·5
BTU/lb. 10,980
S % 0·50
SG 1·387
78·9 % 158/60
Excluded
Excluded
Excluded
M % 5·4
VM % 39·5
FC % 38·7
A % 16·4
BTU/lb 11,240
S % 0·66
SG 1·372
60·6% 159/60
1'5½" gy - wh f sa with carb streaks.
108'5½" 4½" coal with ½ carb sh lens at 1".
1½ carb sh. with num coal lents.
3" coal.
2¼" carb sh with coal lents.
¾ coal
1½ carb sh with num coal lents. → inf coal.
9" coal (v. bkn).
½" dk gy sh. with coal lents
5" coal & carb sh with coal lents & dk gy sh. (v. bkn).
3' gy sh
111'10" 2½" dk gy sh with coal lents.
112'6½" 1" carb sh with coal lents
7¼" coal (very bkn).
1½ inf coal → ca sh with num coal lents; with fn. sh lam at top
2¼ carb sh with num coal lents
114'0½" ⅜ coal (bkn). 2¼ carb. sh with FeCO3 nods.
11½" dk gy sh. → gy sh at btm.
1'2" gy sh.

only the upper two coal sections are worked. Westwards, both this band and the top coal decrease in thickness, so that here the lower two coal sections are worked. The seam has been affected by severe faulting in N.S. 179 and by the intrusion of basaltic sills in N.S. 153, N.S. 180, and N.S. 184. However, a workable section was obtained in N.S. 181, drilled west of the area affected by intrusives (see fig. 4 (*b*)). Because of this, N.S. 195 was drilled some months later to test the possibility of a new mine area in this vicinity. Faulting was encountered in this hole.

On lithological and stratigraphical grounds, the upper two coal sections of the Caledonian No. 5 seam, containing the characteristic fawn shale, are correlated with the **Lowfield seam** (Cameron, 1956*a*), while the bottom coal (the Lower seam of fig. 4) is equivalent to the **seam** found just **below the Lowfield seam** in the west of the Perry's Knob area (Cameron, 1962).

Only one hole, N.S. 153, was drilled to any considerable depth below the Caledonian No. 5 working seam. No other section with a workable coal to stone ratio was penetrated. However, the coal and stone bands occurring at 286 ft. 3 in. are believed to be equivalent to the **Westvale No. 5 seam,** which has been worked in the western part of the coalfield. The lowest coaly horizon was penetrated at 419 ft. 3 in. From this depth to 497 ft. 10 in., typical Walloon sediments, but without coal seams, were penetrated. Below 497 ft. 10 in., coarse pebbly sandstones occur interbedded with the above-type strata. Thus the base of the Walloon Coal Measures occurs at 497 ft. 10 in. in N.S. 153. The beds lying conformably beneath are correlated with the **Marburg Sandstone.**

STRUCTURAL GEOLOGY

Except for slight and irregular undulations in the strata, the Walloon Coal Measures in the Caledonian No. 5 mine area are flat.

Minor faulting has been encountered in mine workings. A narrow fault zone seen in the No. 5 companionway is believed to have been a factor contributing to a fall which resulted in considerable flooding in 1956. This fault is of the normal type, trending north-west–south-east, dipping north at 80 degrees, and having a maximum upthrow to the south-west of 10 in. (Cameron, 1956*b*). Two other tension faults, both having approximately the same trend, dip, and displacement as the first, have since been exposed further to the west. The more easterly of the two increases in intensity towards the north-west, while the other increases in intensity towards the south-east. Such structural weaknesses have been the paths along which intrusion has occurred. These dykes, composed of basalt, vesicular and amygdaloidal, with some well-formed calcite crystals in places, have a maximum thickness of 2 ft. 3 in.

Severe faulting was encountered in N.S. 179. From this and a study of the reduced levels on the base of the Lowfield seam, it is believed that the faulting which stopped progress in the north-west sector of the Caledonian No. 3 Colliery, some 30 chains south-east of the borehole, belongs to the same fault system as that being encountered in the west of Caledonian No. 5 workings. This zone, trending north-west–south-east, is believed to lie just east of N.S. 179.

Because of the faulting encountered in N.S. 195, the full section of the Caledonian No. 5 seam was not present. However, the persistent coaly horizon occuring elsewhere approximately 20 ft. above the working seam was encountered at 200 ft. 8½ in. The next coal beneath this seam is believed to be the top section of the Caledonian No. 5 seam. This coal, occuring at 223 ft. is of workable quality. It is believed that the remainder of the working seam has been faulted out in this borehole. Hence N.S. 195 did not confirm the possibility that a working area in the Caledonian No. 5 seam lies west of the area affected by intrusion. To clarify the position, further drilling in this vicinity would be required.

From information obtained from the western boreholes, and from the mine plan of the now inaccessible Normanton No. 2 Colliery, it is believed that the system of faulting, encountered in this colliery trending east-north-east–west-south-west throws the seam down on the west-north-west side.

Of the northern boreholes, faulting was encountered in N.S. 173, and to a lesser degree in N.S. 172 and N.S. 176. The possibility of a fault trending north-west–south-east, lying between N.S. 173 and N.S. 172 is suggested by a difference of 30 ft. in reduced levels on the base of the Lowfield seam. Undulations of the strata may be a contributing factor, with only small displacement by faulting.

Sills and dykes were common in the holes drilled at the southern end of Mt. Marrow. Thicknesses of these intrusions range from a few inches to over 7 ft. Examination of microslides G.S.Q. 287-289, prepared from the sill occuring at 196 ft. in N.S. 153, shows that it is a basalt with admixed carbonaceous shale (Houston, 1960). Coal in contact with these intrusions has been coked to a depth of up to 15 in. In some cases, the coal is not coked. An example of the effects of these intrusions is shown by the analytical results of the working seam from N.S. 153 (fig. 4 (*b*)). It is reasonable to assume that the water which has accompanied falls in the mine comes from these vesicular and amygdaloidal basalt sills and dykes.

FIG. 4 B

CALEDONIAN No. 5
DIAGRAMS OF WORKING SEAM (LOWFIELD & LOWER)
DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 157

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
M.% 5·7 VM.% 40·6 FC.% 40·0 A.% 13·7 BTU/lb. 11,370 S.% 0·58 S.G. 1364	100·0%	162/60	LOWFIELD	1'9" gy sh., slick. 130'8½" 5½" lt gy f.sa., sa. 1'8½" coal (p.bkn. in btm. 7½")
				132'10½" 5¼" coal (p.bkn).
				10½" carb. sh with num. coal lents.
M.% 6·3 VM.% 36·3 FC.% 38·4 A.% 19·0 BTU/lb. 10,680 S.% 0·55 S.G. 1402	97·7%	163/60 Excluded	LOWER	133'10¼" 1½" fn. sh. 9½" coal (bkn). 1¾" carb. sh with lt. bn–fn. lam. in middle. 5¾" coal (bkn). ¾" lt. bn–fn. sh. 135'8½" 3½" coal (bkn). 4½" carb. sh 1" wh–fn. sh. 2½" coal (bkn). ¼" carb. sh, num. coal l's → inf. coal (bkn). ½" dk gy–carb. sh, FeCO₃ nods. 8" carb. sh with coal lents., with ¼" fn. sh. at 5". 5¼" carb. sh with FeCO₃ nods. 5" coal (bkn). ¼" carb. sh. 138'6½" 3½" fn. sh. 1⅛" dk gy sh. 1½" coal (bkn). 1'2" lt gy sh

N.S. 155

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
M.% 5·9 VM.% 37·2 FC.% 39·6 A.% 17·3 BTU/lb. 10,980 S.% 0·42 S.G. 1384	87·2%	160/60	LOWFIELD	6" gy sh → dk. gy. sh., slick, with few flecks in btm. 2". 155'2" ½" dk. gy. → carb. sh. 1'5" coal → inf. coal in places with ½" carb. sh. with coal lents. at about 3½".
				1½" carb. sh with coal lents. & FeCO₃ nods. ¼" lt. br.–fn. sh. 1" carb. sh. with coal lents. 6¼" coal (bkn. in btm. 5½"). 157'9¼" 1" carb. sh with coal lents. 1" br.–fn. sh. ½" carb. sh, num. coal lents.
M.% 4·8 VM.% 40·5 FC.% 38·4 A.% 16·3 BTU/lb. 11,660 S.% 0·46 S.G. 1351	73·3%	161/60 LOWER		½" fn. sh. ½" carb. sh. 2½" dk gy sh. ½" inf. coal. 158'4" ½" carb. sh. 5" coal. 3" coal (v bkn). ½" carb. sh. 159'7" 2½" lt. br.–fn. sh. 1½" coal → inf. coal. 160'0½" 3½" inf. coal → carb. sh.
				161'2½" 1'10" lt. gy. slts.

N.S. 194

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
A.% 15·3	100·0%	342/60		160'7" 1½" lt. gy. sh., 1" lt. gy. f.sa. 2½" lt. gy. sh. ¼" carb. sh. 1½" coal (bkn). 1" carb. sh with coal lents.
M.% 5·6 VM.% 44·0 FC.% 40·7 A.% 9·5 BTU/lb. 12,890 S.% 0·53 S.G. 1312		LOWFIELD 100·0% 344/60 Excluded		3" coal (bkn). 161'2½" ¾" carb. sh. 2½" fn. sh. 161'8½" ½" coal (bkn). 1'1½" coal (bkn). 4½" dk. bn/carb. sh. 9" coal
M.% 6·6 VM.% 38·4 FC.% 40·1 A.% 14·9 BTU/lb. 11,550 S.% 0·59 S.G. 1339		Excluded 100·0% 345/60 LOWER Excluded		164'0½" 3" dk bn–carb. sh with coal lents. & FeCO₃ nods. in top ½". ½" carb. sh. ½" lt. gy–fn sh. 1½" coal. ½" carb. sh. lt. gy. sh. 1½" coal. 2½" lt. gy–fn. sh. 165'0½" 4½" coal. 1" fn. sh. ½" carb. sh. 9½" coal. ¾" gy–dk gy sh. ½" coal. 1" coal. 3" dk bn–carb. sh, FeCO₃ nods in top ½". 3½" coal. 1½" carb. sh. ½" fn. sh. 1" inf. coal. ½" carb. sh.
				1'7½" coal, inf. in places.
				169'1½" 1½" gy sh. ½" fn. sh. ½" carb. sh. 2" coal (bkn). 1½" dk gy sh. 1½" gy sh. 1'1" lt. gy slts.

N.S. 153

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
				2'3" lt gy sh → gy sh → carb. sh. at base.
A.% 23·9	71·6%	174/60		185'4" 3½" coal (bkn. in btm. 2½"). 1½" inf. coal → carb. sh. with num. coal lents. 2¼" carb. sh with coal lents. 5½" coal (very bkn.). ¼" carb. sh. ¼" coal. ¼" carb. sh., coal lents. ¼" inf. coal.
M.% 3·3 VM.% 34·6 FC.% 44·7 A.% 17·4 BTU/lb. 11660 S.% 0·47 S.G. 1386		LOWFIELD 100·0% 175/60		187'1¾" 2½" carb. sh. 187'4¾" 1¾" coal 3½" fn. sh. ½" carb. sh. ¼" carb. sh with coal lam. near btm. 1' 2¼" coal with ½" carb. sh at 2½" & carb. sh lam. at 3½".
M.% 6·4 VM.% 3·9 FC.% 71·4 A.% 18·3 BTU/lb. 10250 S.% 0·57 S.G. 1730		100·0% 152/60 LOWER 100·0% 153/60		188'9½" 9¼" carb. sh., slickensides. ½" lt. gy sh. 1¾" carb. sh with coal lents. ½" coal. 2½" coal with ½" carb. sh at 1½". 1½" carb. sh. lents. ¾" coal. 2½" lt. gy–fn. sh. 2" carb. sh 2" coal. ½" inf. coal. 1" carb. sh with num. coal lents. 191'5½" 2½" fn. sh. 9" coal. 192'2½" 1" coal. ¾" dk gy sh. ½" carb. sh. 1" coal, sl. coked. 1½" coal, slightly coked. 6¼" sh., baked. 193'3" 3" coal, coked. ½" sh., baked. 6½" coal, coked. 194'3½" 2½" sh., baked. 2'4½" basalt, vesicular & amyg. in top 11".

N.S. 154

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
				1½" lt gy sh. (p.bkn).
A.% 26·5	100·0%	176/60		251'4" 1½" carb. sh with coal lents. 1" dk gy sh. ¼" carb sh 5" coal (bkn). 252'0¾" 2" coal (bkn). ¼" carb. sh with coal lents. 2½" fn. sh. ½" carb. sh 252'6½" 1" coal. ½" carb. sh., coal & fn. sh lents.
M.% 3·2 VM.% 43·8 FC.% 43·1 A.% 9·9 BTU/lb. 12,490 S.% 0·53 S.G. 1313	95·8%	156/60 LOWFIELD		1'3½" coal (v bkn). 253'10" 1' 0½" carb. sh with num. coal lents. ½" lt brsh (bkn). 5½" coal (bkn). 2" coal (bkn). 1½" gy sh with fn sh lents. 256'0¾" 1" coal. 1½" lt gy sh.
		Excluded		1'5" coal (v bkn), with 1" dk gy–br. sh at 5½".
M.% 5·5 VM.% 37·1 FC.% 38·3 A.% 19·1 BTU/lb. 10,730 S.% 0·47 S.G. 1397		Excluded LOWER 96·3% 157/60 Excluded		1" dk gy–carb. sh. ½" coal. 4½" coal (v.bkn). at 2½". 4¼" dk gy–carb. sh with FeCO₃ nods in top 1½" & coal lam. 9" gy sh. 2½" coal (bkn). ½" dk gy sh. 1½" coal (v bkn) 260'7" 2" carb. sh. 6" gy. sh with FeCO₃ nods. in top 3½".

N.S. 181

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
				1'3½" sh., impreg. with Ca.CO₃ above & FeCO₃ below 8".
A.% 28·6	100·0%	184/60		220'6" 1" coal. 2" gy sh., slick. 3" dk gy sh., slick. 1" carb. sh with coal lents., slick. 221'3" 5" inf. coal. 2" carb. sh. 221'8¾" 1" coal with clay lents. ¼" carb. sh. ½" gy sh.
M.% 4·8 VM.% 40·1 FC.% 40·0 A.% 15·1 BTU/lb. 11,520 S.% 0·48 S.G. 1358		LOWFIELD 100·0% 170/60		2'2½" coal → inf. coal in places in top 3", with sh. lam. ¼ from base.
				224'2¼" 1" fn. sh. ¼" coal. ⅛" dk gy–gy. sh. ⅛" inf. coal → carb. sh.
M.% 5·0 VM.% 39·0 FC.% 38·1 A.% 17·9 BTU/lb. 11,490 S.% 0·44 S.G. 1382		Excluded Excluded LOWER 98·4% 171/60 Excluded		224'9¼" 1¼" fn. sh. 8¼" coal with sh. lam. at 5½" & 6½". ¼" dk gy & fn. sh. 6½" coal. 1" fn. sh. ½" coal. ½" carb. sh. with coal lents. ½" carb. sh. 2½" coal (p.bkn). ⅛" lt. br. sh. 1" carb. sh. 2½" dk gy sh. ½" gy sh.
				1'8" coal with sh. lam. at 1'6½".
				228'8" ⅛" gy. sh. ½" lt. gy. – wh. sh. ¼" carb. sh. ¼" dk gy sh. ½" lt. gy. slts. 4½" gy. sh. 1'6" lt. gy. slts.

A

Prox Anal., Cal. value S., S.G. etc.	Recovery percent	Sections sampled	Seam section	Description
				gy. sh. roof.
M.% 5·8 VM.% 37·3 FC.% 39·1 A.% 17·8 BTU/lb. 10,900 S.% 0·52 S.G. 1388		LOWFIELD 172/60 Excluded LOWER Excluded		5½" coal. 3½" carb. sh. ⅛" coal (lenticular). 2½" fn. sh. 1½" coal. ½" dk gy sh. with fn. sh. lents. 2'3½" coal. 3½" carb. sh. with num. coal lents. 1" fn. sh. 1" coal. ½" carb. sh. 1½" gy sh. 2" coal → inf. coal. ¾" fn. sh. 5½" coal. ¼" dk gy sh. 1'0½" coal. 1" dk gy sh. 6½" coal. sh. floor.

FIG.4c

CALEDONIAN No.5
DIAGRAMS OF WORKING SEAM (LOWFIELD & LOWER)
DETAILS OF CORE RECOVERY AND ANALYSIS

N.S.166

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
A%	7·6	100%	1508/59	95'11¼"	1 gy.sh.
				96'6¼"	7" coal
					9" carb.sh w.num.fn.sh lents. in blm. 1"
				97'3¼"	
			LOWFIELD		
M.%	5·1	100%	1486/59		3'0¼" coal
VM.%	10·8				
F.C.%	41·4				
A%	12·0				
B.T.U./lb.	11950				
S%	0·51			100'3½"	
S.G.	1·336				1'8½" l gy.sh.
					2" l gy f sa. 5¾" l gy sh.
					4½" dk gy.sh. 1½" gy sh w ½" l gy-fn sh in mid
				103'3¾"	1 dk gy.sh. 1" inf. coal 1¼" dk brn. sh.
M.%	6·6		Excld.		2¾" coal 2" carb.sh. 1¼" inf. coal
VM.%	37·4		LOWER		
F.C.%	38·4	100%	1487/59		11" coal
A.%	17·6		Excld.		2½" brn.sh.
B.T.U./lb.	10720				9¼" coal
S%	0·57			105'1·0"	
S.G.	1·396				gy sh.

N.S.174

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
A.%	16·8	100%	1514/59	107'8½"	gy wh.f.sa.
				107'10¾"	1¼" coal 1¼" inf coal 4½" carb.sh.w.coal lents.
				108'4¾"	1¼" fn sh. 2¼" coal ¼" carb.sh. ¼" fn.sh.
					¼" carb.sh. 2½" coal ¾" carb.sh.w.num.coal
			LOWFIELD		1'3½" coal w ½" l gy.sh. lents → inf coal.
M.%	5·9	100%	1496/59		at 10½"
VM.%	37·7				1¼" carb.sh.w.num.coal lents.
F.C.%	40·0				1'0" coal ¾" carb.sh.w.num.coal lents.
A.%	16·4			111'5"	½" coal ¼" fn.sh. ½" carb.sh.
B.T.U./lb.	11090				6" gy.sh.
S%	0·53				9½" interbd.l gy.slts.and l gy.sh.
S.G.	1·381				10" gy.sh.
					1½" carb.sh. 1" coal 1½" dk gy.-carb.sh.
M.%	7·0				2" l gy.sh. 2½" dk.gy.sh.
VM.%	36·7				5" (b.c) coal ½" carb.sh. 5" (b.c) coal
F.C.%	40·1		LOWER		1½" l gy.-fn.sh 2¾" carb.sh.w.coal & fn.sh. lents.
A.%	16·2	100%	1497/59		½" coal 2¼" dk gy.sh.
B.T.U./lb.	10960		Excld.		7¾" coal (b.c) w.sh. lam. & lents in top 1"
S%	1·01				and ¼" dk.gy.sh. at 4½"
S.G.	1·391			116'4½"	gy.sh.

N.S.168

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
A.%	9·1	65·6%	1510/59	106'4"	dk.gy.sh.
					8" (b.c) coal
				107'2¾"	
				107'9¾"	7" carb.sh.
			LOWFIELD		11" coal w. fn.sh. lents.
M.%	5·2	100%	1489/59		¾" carb.sh.w.coal lents.
VM.%	40·1				1'8¼" coal w.sh. lam. at 11" and 1'0"
F.C.%	38·5				
A.%	16·2				
B.T.U./lb.	11330				
S%	0·39			110'5¾"	1½" fn.sh. 1" coal
S.G.	1·893				1'4" gy.sh.
M.%	7·2			112'2¾"	2" l gy-fn.sh. ¼" dk.gy.sh. 2¼" coal
VM.%	36·8		Excld.		2¼" (b.c) inf. coal 2¼" dk.brn. sh. 2¾"
F.C.%	41·0	88·4%	1490/59		2½" (b.c) coal w. ¼" brn.-fn.sh. at ¾"
A.%	15·0		LOWER		1' l gy-fn.sh. 1¼" coal ½" carb.sh.
B.T.U./lb.	11050		Excld.		2¼" (b.c.) coal 1" fn.sh.
S.%	0·53				9½" (b.c) coal
S.G.	1·374			114'6¾"	l gy.slts.

N.S.175

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
				168'11¼"	6" l gy.sh.impreg.w. FeCO3 in top 2"
					1¼" dk.gy.sh. 3" carb sh. 1½" fn.sh.
M.%	6·0			169'5¾"	1½" coal ¾" dk.gy.-carb.sh.
VM.%	38·9				
F.C.%	38·8		LOWFIELD		2'7" coal w. ½" carb.sh. bands at 1'2"
A.%	16·3	100%	1498/59		and 1'4"
B.T.U./lb.	11050				
S.%	0·58				
S.G.	1·375			172'0¾"	1½" fn.sh. 1¼" coal ½" dk.gy.sh. 4½" gy.sh.
				172'11½"	¾" carb.sh. 1½" coal
M.%	7·5		Excld.		4½" coal 2½" brn.sh.
VM.%	36·9				7¾" coal 1¼" l gy.sh. 1½" coal ½" dk.gy.sh.
F.C.%	40·2		LOWER		
A.%	15·4	100%	1499/59		4½" coal 2½" fn.sh.
B.T.U./lb.	11280		Excld.		
S%	0·60				10" coal
S.G.	1·371			175'10¾"	gy.sh.

N.S.172

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
A.%	7·2	87·5%	1512/59	160'9½"	intbd.l gy sh. and gy.wh.f.sa.
				161'4¾"	6" (v.b.c) coal
				162'0"	7¾" carb.sh.
			LOWFIELD		4" coal 1¾" carb.sh.w.coal lents.
M.%	6·0	95·2%	1492/59		9½" (b.c) coal → inf coal in places w. ¼"
VM.%	38·9		Excld.		carb.sh.at 7"
F.C.%	37·1				1½" carb sh w coal lents. ¼" fn.sh.
A.%	18·0				1'1" (v.b.c) coal
B.T.U./lb.	9270			164'7½"	1½" l gy.-fn.sh.
S.%	0·46				1'0½" gy.sh. → slts. in places
S.G.	1·393				1½" gy.sh. ¾" fn.sh. ¼" dk gy.sh. 2½" (v.b.c) carb.sh.
					1¼" (b.c) coal 4¼" carb sh.w num.coal lents.
M.%	7·8		LOWER	166'10¾"	2¼" dk gy.-carb sh. 2¼" (p.b.c) coal
VM.%	37·0		Excld.		1¼" gy.sh. 1" carb.sh.
F.C.%	41·0				1'0" (b.c) coal w. ¼" brn.sh. at 4"
A.%	14·2	85%	1493/59		
B.T.U./lb.	12420				
S.%	0·61				
S.G.	1·368			168'6¾"	8" gy.sh. 1" carb.sh.
					interbd.l.gy.sh. and slts.

N.S.176

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
				168'0½"	l gy.sh. 2½" dk.gy.sh. 2½" carb.sh. 1¼" fn.sh.
				168'4¼"	¾" carb.sh. ½" coal ¾" carb.sh. 1¼" coal
M.%	5·1		Excld.		¾" fn.sh. 3¼" coal ½" carb.sh.
VM.%	40·4				10" coal
F.C.%	38·4		LOWFIELD		1½" dk gy → carb.sh.
A.%	16·1	100%	1500/59		1'5¾" coal
B.T.U./lb.	11350		Excld.		
S%	0·59				
S.G.	1·375			171'5½"	1" l gy.-fn.sh. 2¼" coal
					6" gy.sh.
M.%	6·6			172'6¼"	1" carb.sh. 2½" l gy.-fn.sh.
VM.%	37·8		Excld.		6¼" coal 1" fn.sh. 1¼" coal ¾" dk gy -carb.sh
F.C.%	42·1		LOWER		
A.%	13·5	91·6%	1501/59		7" coal
B.T.U./lb.	11500		Excld.		½" l brn.sh.
S.%	0·52				9½" (v.b.c) coal
S.G.	1·397			175'0"	gy.sh.

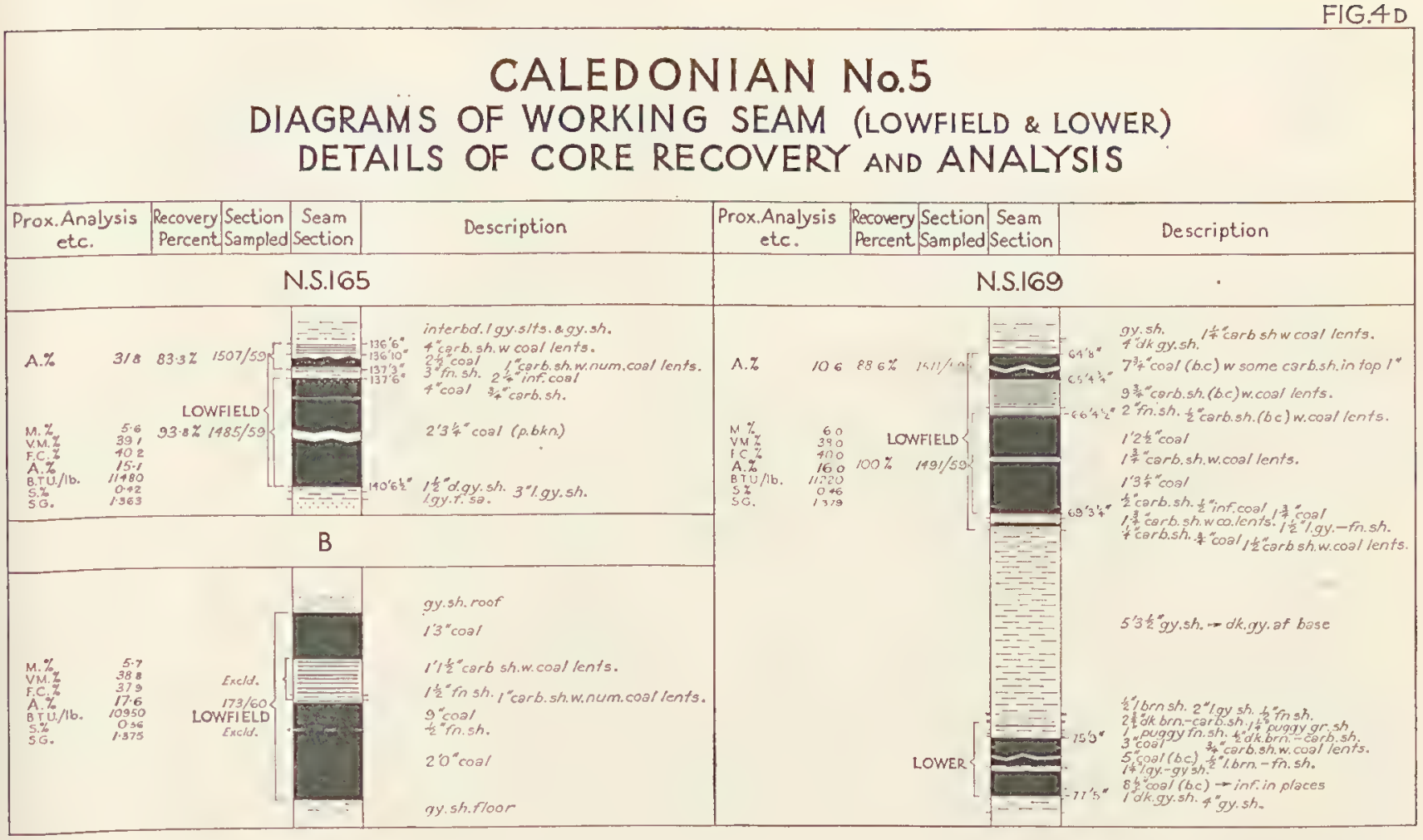
N.S.173

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
A.%	11·6	100%	1513/59	123'2"	gy.wh.f.sa. 2½" (b.c) coal
				123'4½"	5½" carb.sh.
				23'10"	
			LOWFIELD		
M.%	5·3	100%	1494/59		3'0½" coal w.sh.lam.at ¾" and 1'4½"
VM.%	39·7				
F.C.%	39·4				
A.%	15·6				
B.T.U./lb.	11340				
S.%	0·84				
S.G.	1·375			126'10½"	1½" l gy.-fn.sh. slick. 1¾" coal
					11½" l gy.sh.
					¾" coal 2" carb sh w ½" coal lens at 1"
					1½" dk gy sh 1½" l gy.-fn sh 2½" dk gy carb sh
M.%	7·4			128'11"	1' gy.sh. ½" l gy.-fn.sh. 4" coal ½" dk gy.sh.
VM.%	36·8		LOWER		3½" coal ¾" l gy.-fn sh
F.C.%	40·0		Excld.:		2¼" carb.sh.w.num.coal lents.
A.%	15·8	100%	1495/59		5¼" coal 2" l gy.-fn.sh.
B.T.U./lb.	10980		Excld.:		
S.%	0·67				9½" coal
S.G.	1·381			131'2¾"	gy sh.

N.S.178

Prox.Analysis etc.		Recovery Percent	Section Sampled	Seam Section	Description
				125'5"	l gy.sh. ¼" carb.sh.
					4" (b.c) coal 2¾" (p.b.c) carb.sh.w coal lent.
					1'2" dk. brn. - carb.sh.
					1¾" brn. sh. 1¾" fn.sh.
M.%	6·0		LOWFIELD	127'10"	5" carb. sh. 3" coal
VM.%	38·0				1¾" carb.sh.w.num.coal lents. ¾" gy.sh.
F.C.%	36·5				
A.%	19·5	100%	1504/59		1'7½" coal → inf. between 4½" and 6"
B.T.U./lb.	10540				
S.%	0·62				
S.G.	1·400			129'11"	2¼" fn.sh. 1½" (b.c) coal
					4¾" gy.sh. ½" carb.sh. 1" coal 2½" fn.sh.
				130'11"	
M.%	7·1				9" coal w. ¼" fn.sh. at 5½"
VM.%	36·9		LOWER		2¼" carb sh ¼" fn sh lens 3" carb.sh. ¾" coal
F.C.%	43·4		Excld.		1" l gy.sh. ½" carb.sh.
A.%	12·6	100%	1505/59		6" coal 2" fn.sh.
B.T.U./lb.	11370		Excld.		10" coal
S.%	0·61				
S.G.	1·354			133'5"	dk gy.sh.

FIG.4D


CALEDONIAN No.5
DIAGRAMS OF WORKING SEAM (LOWFIELD & LOWER)
DETAILS OF CORE RECOVERY AND ANALYSIS
Prox. Analysis etc.
Recovery Percent
Section Sampled
Seam Section
Description
N.S.165
A.% 3/8 83·3% 1507/59
LOWFIELD
M.% 5·6
VM.% 39·1
F.C.% 40·2
A.% 15·1
B.T.U./lb. 11480
S.% 0·42
S.G. 1·363
93·8% 1485/59
136'6" interbd. l.gy.slts. & gy.sh.
136'10" 4" carb. sh. w coal lents.
137'3" 2¾" coal 1" carb. sh. w. num. coal lents.
137'6" 3" fn. sh. 2¼" inf. coal
4" coal ¾" carb. sh.
2'3¼" coal (p.bkn.)
140'6½" 1½" d.gy. sh. 3" l.gy. sh.
l.gy.f. sa.
B
M.% 5·7
VM.% 38·8
F.C.% 37·9
A.% 17·6
B.T.U./lb. 10950
S.% 0·56
S.G. 1·375
Excld.
173/60
LOWFIELD
Excld.
gy. sh. roof
1'3" coal
1'1½" carb sh. w. coal lents.
1½" fn. sh. 1" carb. sh. w. num. coal lents.
9" coal
½" fn. sh.
2'0" coal
gy. sh. floor
N.S.169
A.% 10·6 88·6% 1511/1
LOWFIELD
M.% 6·0
VM.% 39·0
F.C.% 40·0
A.% 16·0
B.T.U./lb. 11220
S.% 0·46
S.G. 1·379
100% 1491/59
LOWER
64'8" gy. sh. 1¼" carb sh w coal lents.
4" dk gy. sh.
65'4¾" 7¾" coal (b.c) w some carb. sh. in top 1"
9¾" carb. sh. (b.c) w. coal lents.
66'4½" 2" fn. sh. ½" carb. sh. (b.c) w. coal lents.
1'2½" coal
1¾" carb. sh. w. coal lents.
1'3¼" coal
69'3¼" ½" carb. sh. ½" inf. coal 1¾" coal
1¾" carb. sh. w co. lents. 1½" l.gy.—fn. sh.
¼" carb. sh. ¾" coal 1½" carb sh. w. coal lents.
5'3½" gy. sh. → dk. gy. at base
75'5" ½" l brn sh. 2" l gy sh. ½" fn sh.
2¾" dk brn.-carb. sh. 1½" puggy gr. sh
1" puggy fn. sh. ½" 1¾" puggy gr. sh
3" coal ¾" ½" dk. brn. - carb. sh.
5" coal (b.c) ½" carb. sh. w. coal lents.
1¼" l.gy.-gy sh. ½" l.brn. - fn. sh.
77'5" 8½" coal (b.c) → inf. in places
1' dk. gy. sh. 4" gy. sh.

COAL RESOURCES

Cameron (1963) has previously set out the requirements for workability of seam sections and for estimation of reserves, both measured and indicated, for this coalfield.

Measured reserves have been established in both the Lanefield No. 5 seam and the underlying Caledonian No. 5 seam.

Reserves extending over an area of 70 acres embracing boreholes N.S. 154-156 and N.S. 158-161, have been established in the **Lanefield No. 5 seam "tops".** Where the roof or floor stone is thin, the "top coal" or the "bottoms" of the seam may also be worked. These reserves in the "tops" have an average working section of 3 ft. 10½ in. containing 3 ft. 4½ in. of coal with a weighted average ash content of 15·5 per cent. Total tonnage amounts to 408,000 tons.

To the west of the present workings, reserves in the **Caledonian No. 5 seam** extend over an area of 34 acres. Average working thickness is 5 ft. 7 in. Average coal thickness is 4 ft. 3 in., weighted average ash content being 15·3 per cent. These reserves amount to 239,000 tons, but may not all be available because of the possibility of a fault zone occurring in this area.

To the north, reserves may be arbitrarily divided into two areas. Surrounding the easterly boreholes N.S. 168, N.S. 172, N.S. 175-176, and N.S. 178, reserves have been established in the Caledonian No. 5 seam to the extent of 74 acres. The average coal thickness of 4 ft. 10 in. is contained in an average working thickness of 7 ft. 0 in., weighted average ash content of coal being 15·3 per cent. Total tonnage amounts to 600,000 tons. Adjoining and to the west of this area of reserves, and surrounding boreholes N.S. 165-166, and N.S. 173-174, reserves have been calculated for the Lowfield seam only. The light grey shale separating the Lowfield seam from the rest of the working seam has grown to over 6 ft. in this sector. These reserves extend over an area of 67 acres. The average working thickness of 3 ft. 10½ in. contains an average coal thickness of 3 ft. 5½ in. Weighted ash content is 15·4 per cent. These reserves amount to 380,000 tons. Hence measured reserves north of the present workings extend over 141 acres and amount to 980,000 tons.

NATURE OF COAL

The coal of the seams in which reserves have been established is of high volatile bituminous rank. Fixed carbon calculated on a dry, mineral-matter-free basis varies from 47·1 per cent. to 54·9 per cent. Calorific value calculated on a moist, mineral-matter-free basis varies from 11,510 to 14,690 B.Th.U. per lb. No coking tests were carried out.

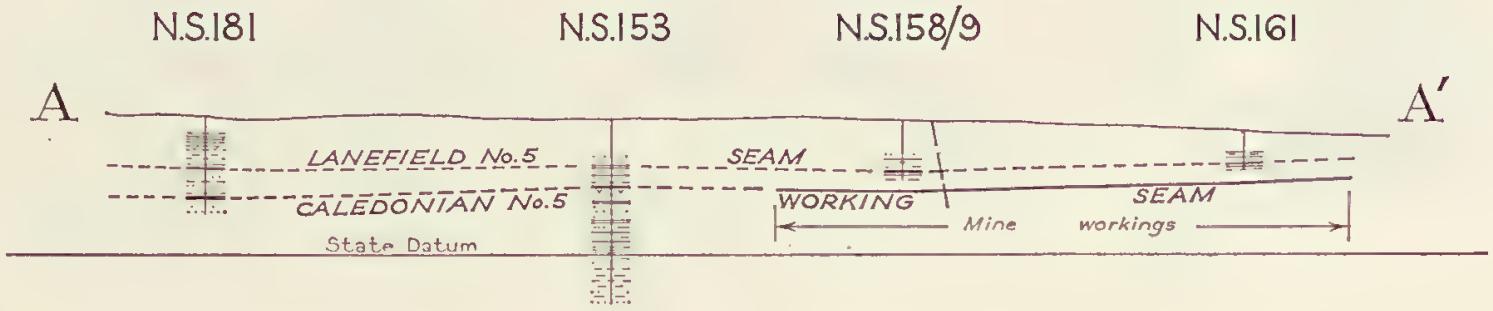
FIG. 5

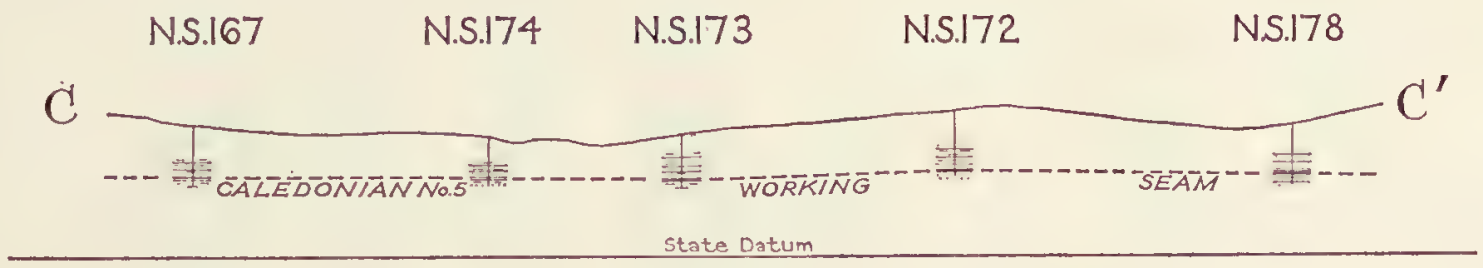
CALEDONIAN No.5 · CROSS SECTIONS

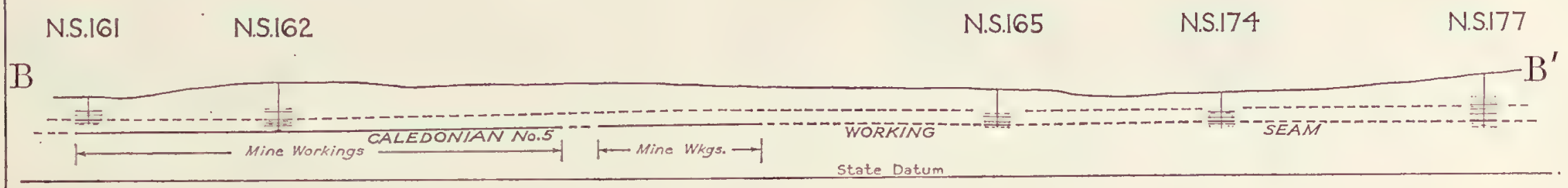
NATURAL SCALE

10 0 10 20 Chains

500 0 500 1000 Feet







CONCLUSIONS

Diamond drilling of the Caledonian No. 5 mine area has proved measured reserves in two seams—the Lanefield No. 5 seam and the present working seam which comprises the Lowfield seam and the coal seam occurring just below.

These reserves have been calculated as follows:—

	Tons
(*a*) Lanfield No. 5 seam "tops" ..	408,000
(*b*) Caledonian No. 5 seam—	
(i) Western sector	239,000
(ii) Northern sector	980,000
Total	1,627,000

REFERENCES

CAMERON, J. B., 1956*a*: Coal resources—Rosewood-Walloon coalfield (Lanefield No. 5 mine area). *Qld Govt Min. J., 57,* 457-459.

————, (1956*b*): Caledonian No. 5 Colliery, Rosewood. Unpub. rep. Geol. Surv. Qld.

————, 1962: Coal resources—Rosewood-Walloon coalfield (United No. 8 mine area). *Qld Govt Min. J., 63,* 125-137.

————, 1963: Coal resources, Rosewood-Walloon coalfield (New Mountain View mine area). *Geol. Surv. Qld Publ.,* 310, 1-8.

HAWTHORNE, W. L., 1954: Coal resources—Rosewood-Walloon coalfield (Malabar mine area). *Qld Govt Min. J., 55,* 225-232.

HOUSTON, B. R., (1960): Petrological report on core from Rosewood coalfield: bore N.S. 153, 196 ft. Unpub. rep. Geol. Surv. Qld.

13th February, 1961.

COAL RESOURCES, ROSEWOOD–WALLOON COALFIELD (NEATH MINE AREA—SUPPLEMENT)

By E. S. Chiu Chong

SUMMARY

As part of the systematic diamond drilling programme of the Rosewood Coalfield, boreholes N.S. 228-230 were drilled in Neath mine area during May and June, 1961. These holes were sited to the north-east of abandoned mine workings. Borehole N.S. 27 had previously been drilled to the south-west of workings.

Correlation of the seams penetrated in the present holes with those obtained in N.S. 27 has been established.

Information obtained from the drilling suggests a fault within the area.

No reserves of coal were established by this drilling programme.

INTRODUCTION

During the testing of the adjoining Normanton No. 1 mine area in 1954, one diamond drillhole, N.S. 27 was drilled in Coal Mining Lease No. 318, held by Neath Collieries Pty. Ltd. In May and June, 1961, further holes, N.S. 228-230, were drilled in this lease some 20 chains ahead of abandoned mine workings to determine whether there was any improvement in the seams.

Two sites were selected, but due to poor core recovery in N.S. 229 around the horizon of the Neath Top seam, N.S. 230 was also drilled at that site. Total footage drilled was 1,177 ft. 7 in. Footage cored totalled 954 ft. 5 in., recovery being 89·5 per cent. Excluding the Neath Top seam in N.S. 229, recovery in target coal seams was 98·5 per cent.

This report is accompanied by the following plans, sections, and diagrams:—

(*a*) Plan showing positions of boreholes, extent of abandoned mine workings, surface contours at 10 ft. intervals and sub-surface levels on State Datum—fig. 1.

(*b*) Generalised bore sections—fig. 2.

(*c*) Diagrams showing details of seam sections and results of analyses—fig. 3.

(*d*) Correlation diagram of New Malabar seam—fig. 4.

(*e*) Two cross-sections—fig. 5.

Seam sections recovered were examined by an Engineer Member of the Queensland Coal Board. Sampling was designed to assess as accurately as possible the quality of the product that could be marketed after handpicking of stone both underground and on the surface. All analyses were carried out by the Government Chemical Laboratory.

SUBSURFACE GEOLOGY

Cameron (1960) described the geology of the mine area and correlated the seams worked in Neath Nos. 1 and 2 Collieries with those encountered in the Normanton No. 1 mine area and in borehole N.S. 27.

Tertiary basalt and associated sediments form a protective capping over the Walloon Coal Measures of Jurassic age, the junction being uncomformable. In N.S. 228, these Tertiary rocks are some 200 ft. thick.

The **Neath Top seam,** as first worked, has been correlated with the Normanton No. 1 seam. Later workings included part of the underlying Normanton No. 2 seam, the interval between these seams hereabouts being less than 2 ft. This interval is some 14 ft. in N.S. 228.

The **Neath Bottom seam,** correlated with the Normanton No. 3 seam, lies some 20-30 ft. lower, the intervening strata being shale with some coal bands. The section as worked in Neath No. 1 Colliery was over 5 ft., and contained a persistent median shale

FIG. 1

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

NEATH MINE AREA – SUPPLEMENT

WALLOON–ROSEWOOD COALFIELD

Showing boreholes, mine workings & topography

To accompany a report by E.S. Chiu Chong, B.Sc., Geologist

SCALE OF CHAINS 10 8 6 4 2 0 10 20

SURVEY DATA WJR 1.3.62

1 Twenty chain grid on True North. Point of origin, Perry's Knob Trig. Station
Elevations in feet on State Datum
Topographic survey by Ewan Cowley, Assistant Surveyor

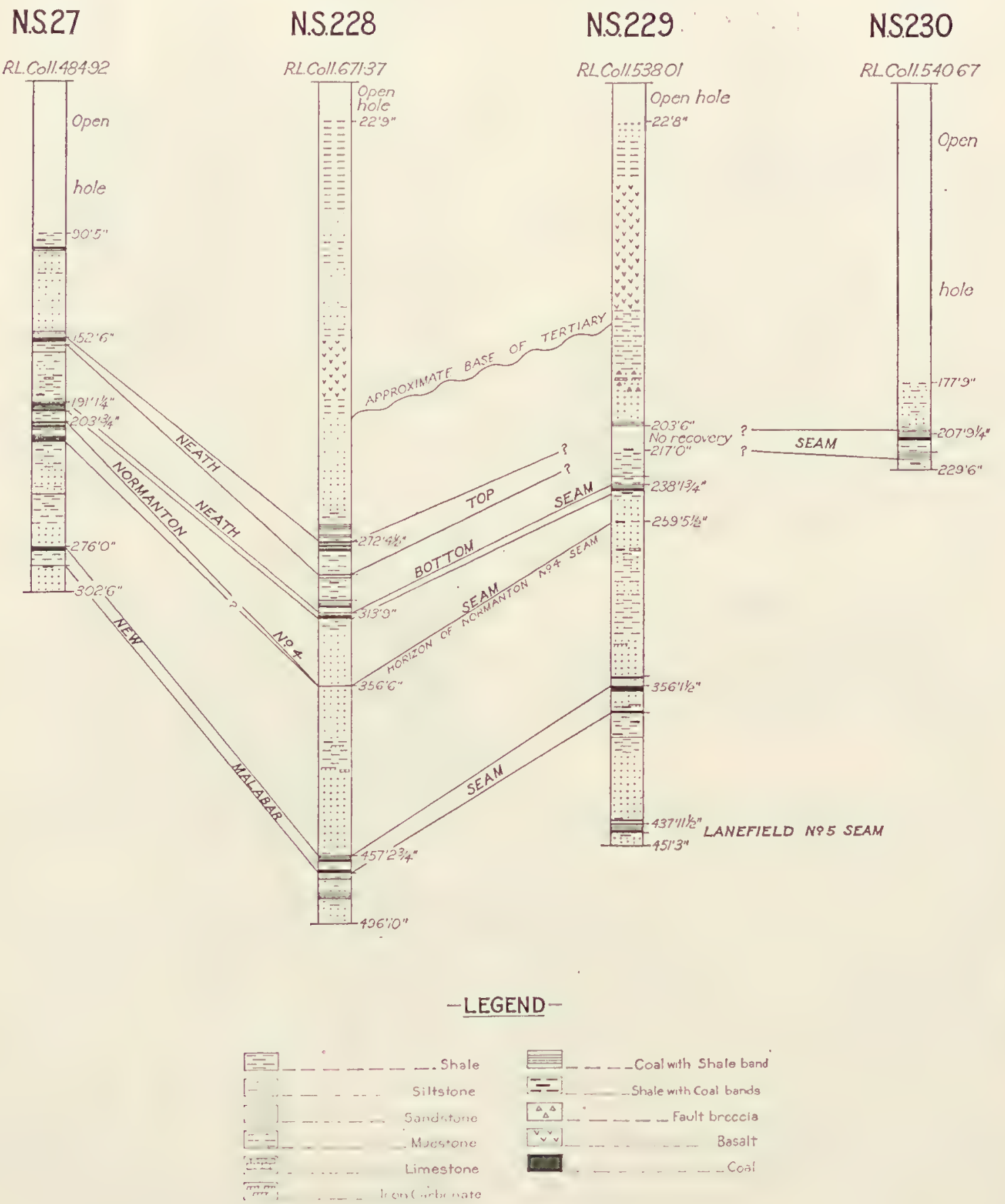
396
451
395
501
653
644
457
460
N.S. 228
RL SURF 670·37
RL COLL 671·37
N.S. 230
RL SURF 539·50
RL COLL 540·67
N.S. 229
RL SURF 536·76
RL COLL 538·01
P.D. Nº2
RL SURF 623·16
P.D. Nº1
RL SURF 543·30
N.S. 27
RL SURF 483·42
RL COLL 484·92
N.S. 40
N.S. 25/26
RL SURF 434·57
RL COLL 435·75
NEATH Nº2 A
NEATH Nº1 A
JL Embrey's Tunnel
JL Mason's Btm. Tunnel
QUARRY
A
B
X
Y
2000 S
4000 S
6000 S
2000 E
4000 E
6000 E

EXPLANATION

Diamond drillhole ⊙ 27 Percussion drillhole ○ P.D Nº1
Colliery (aband) NEATH A Surface Contours —250—
Cross Section line X——X' Shaft ■ Adit
Limit of Mine Workings on:– Neath Top Seam
Neath Bottom Seam
Elevations taken from mine plans and reduced to State Datum ○340' Seam Sect^n measured ⊗

FIG. 2

NEATH – SUPPLEMENT
GENERALISED BORE SECTIONS



LEGEND

- Shale
- Siltstone
- Sandstone
- Mudstone
- Limestone
- Iron Carbonate
- Coal with Shale band
- Shale with Coal bands
- Fault breccia
- Basalt
- Coal

WJR 4 5 62

FIG. 3A

NEATH – SUPPLEMENT

DIAGRAMS OF NEATH TOP AND BOTTOM SEAMS
DETAILS OF CORE RECOVERY AND ANALYSIS

NEATH TOP SEAM

Analysis Etc.	Per cent Recovery	Section Sampled	Seam Section	Description
N.S. 228				
M % 7·8 VM % 37·1 FC % 38·9 A % 16·2 BTU/lb. 11060 S % 0·51 Sg. 1·357	100 %	688/61	Excl. Excl. Excl.	7" waxy l gy. sh. 1" carb. sh; ½" (b.c) coal; 1" (p.b.c) carb sh 1¼" l gy. waxy sh; 1" carb. sh. 4" l gy. waxy sh; 1½" carb. sh; 1¾" inf. coal 1" coal; 1¼" carb. sh. w. num. coal lents 272' 4½" ¾" br. sh; 1¼" carb. sh; 3½" (b.c) coal ½" fn. sh; ½" carb. sh; 7" (b.c) coal ¼" carb. sh; 3¼" fn. sh; 2" (b.c.) coal and carb. sh; 2" l. gy. waxy sh 1' 4" (b.c) coal 3' dk. gy. sh. w. iron. carb. nods. 2¼" carb. sh. 1' 1½" (b.c) coal 276' 10¼" 8½" dk gy. sh.
N.S. 230				
M % 6·6 VM % 37·6 FC % 39·1 A % 16·7 BTU/lb. 11020 S % 0·57 Sg. 1·374	97·9 %	229/62	Excl. Excl. Excl. Excl.	291' 0¾" 2½" (b.c) carb. sh; ½" inf. coal; ¼" carb sh 1" inf. coal; 1" (b.c) carb sh; ¼" fn. sh. 1¾" inf. coal; 1½" (b.c) coal; 2½" fn. sh. 1½" inf. coal; 2¾" fn. sh; 2" coal 1¾" carb. sh; 2½" (b.c.) coal 292' 11¼" ¾" (p.b.c) carb. sh; 2½" (p.b.c) coal 11¼" fn. sh. 207' 9¼" 2¼" carb. sh; 2¾" coal; 1¾" fn. sh. 2¾" coal; 1½" inter bd. fn. sh. and carb. 5½" coal; ½" l gy. waxy sh; ½" inf. coal sh. 1¼" carb. sh; 1" coal; 1¾" fn. sh; 1½" carb. sh 3¼" coal ½" carb. sh; 2¼" l gy. sh.; ½" carb. sh. 1' 8½" coal, b.c. btm. 4" 211' 10" 4" carb. sh.; 3¼" gy. sh.
MINE WORKINGS "A"				
6' 6¼" Working Section				3" coal 3" fn. sh. 1' 5" coal 1½" coaly sh. 11½" gy. sh. 2½" l gy. sh. 8" coal, w. ½" brn. sh. at 5" 1½" fn sh; 2½" coal ¾" carb. sh w. coal lents; 1" coal; 1½" fn. sh; ½" carb. sh; ¾" coal ½" carb. sh; 3" fn sh; 1" coal 1¼" carb. sh. w. coal lents; 2½" dk gy sh. 9" coal

NEATH BOTTOM SEAM

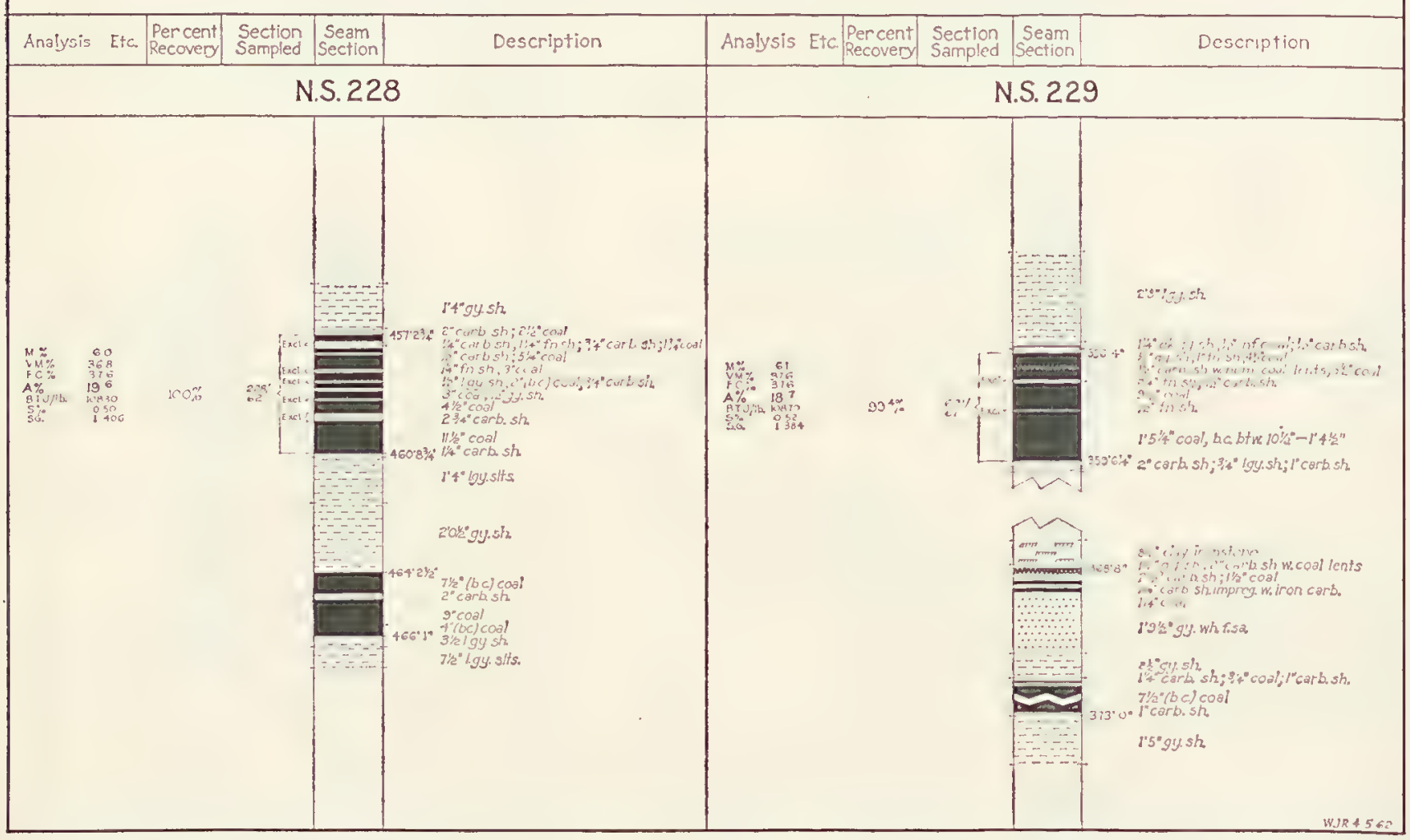
Analysis Etc	Per cent Recovery	Section Sampled	Seam Section	Description
N.S. 228				
M % 6·8 VM % 37·2 FC % 38·3 A % 17·7 BTU/lb. 10890 S % 0·52 Sg. 1·360	95·1 %	689/61	Excl. Excl.	308' 5" 2½" carb. sh. 6" (b.c) coal 4" fn. sh. 7" (p.b.c) coal 1" carb. sh. w. coal lents; 1" (b.c) inf. coal 2¼" (p.b.c) carb. sh.; 2" (b.c) coal 1¼" (b.c) carb. sh.; 2½" (b.c) coal 8" carb. sh. w. ¼" l gy. sh. at 3" 2" dk. gy. sh. w. iron. carb. nods. 5½" gy. sh.; 1½" dk. gy. sh. 3" gy. sh. 9½" dk. gy. sh. ½" carb. sh.; ½" fn. sh. lens 313' 9" 8¼" coal, b.c. btm. 3" ¾" l. gy. sh. 6½" (b.c.) coal 3½" (p.b.c.) dk. gy. sh. 1' 8" (b.c) coal, w. some br. sh. frags. in btm. 3" 317' 4" 1" carb. sh.; 1" (b.c) coal 4½" dk. gy. sh.
N.S. 229				
M % 5·7 VM % 38·5 FC % 40·5 A % 15·3 BTU/lb. 11390 S % 0·47 Sg. 1·349	100 %	690/61	Excl. Excl. Excl.	238' 1¾" 1¼" dk. gy. sh.; 3¾" carb. sh. w. coal lents; 1¾" brn. sh. ¾" carb. sh. w. coal lents; 4½" brn. sh. 5½" coal, inf. in top 1"; ¾" fn. sh. 4" coal; ¾" carb. sh. 5" coal ½" fn. sh; 5" coal 2" dk. brn. sh. 7½" gy sh w iron carb. nods. in top 4" 1½" brn. sh. 3½" gy sh; 1" carb sh. 1' 3¾" (p.b.c.) coal w. ½" carb. sh. at 9" 242' 6½" 1¼" carb. sh.; 2¾" dk. gy. sh. 1½" dk. gy. sh. w wh. sh. lents; 2½" wh. sh 2¾" waxy fn. sh.
MINE WORKINGS "B"				
5' 5" Working Section				3" white sh. 4" coal 4" sh. 1' 4" coal 1" sh. 5" coal; 2" sh. 2" coal 1' 2" sh 7" coal 1" sh 6" coal

W.J.R. 4.5.62

FIG. 3B

NEATH – SUPPLEMENT

DIAGRAMS OF NEW MALABAR SEAM · DETAILS OF CORE RECOVERY AND ANALYSIS



band of less than 2 ft. In the bores, the seam was approximately 4 ft. thick, due mainly to a reduction in the thickness of the top coal.

A seam approximately 7 ft. below the Bottom seam in N.S. 27 has been correlated with the Normanton No. 4 seam. An 8½ in. coal band occuring some 40 ft. beneath the Bottom seam in N.S. 228 is believed to be on an equivalent stratigraphic horizon, the remainder of the seam having been contemporaneously eroded as shown by the sandstone lying above the coal.

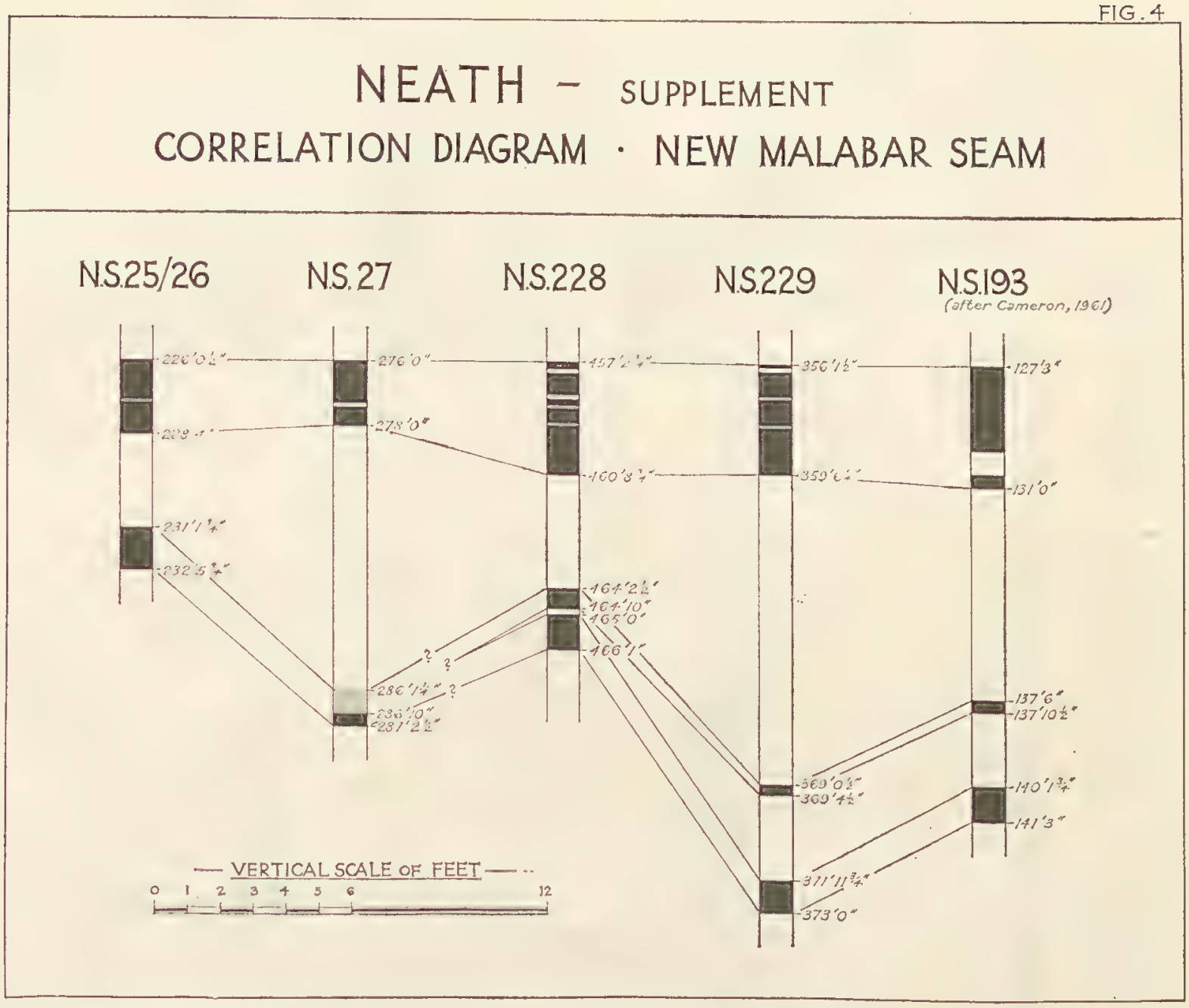
The next seam of any significance lower in the sequence is the **New Malabar seam,** occurring some 90 ft. deeper, the intervening strata being predominantly sandstone. The waxy shale and coal bands, which elsewhere persistently overlie the seam, are also present in this area. To the north-east, the growth of a median stone band to as much as 8 ft. has been recorded in the New Malabar seam by Hawthorne (1954), and Cameron (1963). In the bores, the band between "tops" and "bottoms" increases to approximately 9 ft. Cameron also recorded the growth of a grey shale band from a few inches to over 1 ft. in the "bottoms". This band is over 2 ft. in N.S. 229. Hence variations in the New Malabar seam in the area are comparable with those noted in N.S. 193, the nearest borehole to the north-east (see fig. 4).

Only N.S. 229 was continued below the New Malabar seam. A seam occurring at 437 ft. 11½ in., some 80 ft. lower, is correlated on stratigraphic and lithological grounds, with the **Lanefield No. 5 seam** of the Normanton No. 1 mine area (Cameron, 1959).

STRUCTURAL GEOLOGY

Regional dip of the Walloon Coal Measures in the Neath mine area is approximately 2 degrees to the south. Only minor faults were encountered in

FIG. 4



mine workings (Mellor, 1953). Again, in N.S. 229, faulting was encountered above the horizon of the Top seam. However, in this hole, all seams were intersected some 50-70 ft. lower than expected. This discrepancy can be explained only partly by local undulations in the strata. Hence the possibility of a fault lying to the east of mine workings and N.S. 228, and to the west of N.S. 229, cannot be overlooked. This fault would thus trend north-west–south-east. Downthrow would be to the north-east, maximum displacement being some 70 ft.

COAL RESOURCES

At no stage during the life of Neath Collieries did either the Top or Bottom seams present a really attractive working section. It was in the north-east workings that the Top seam showed some signs of improvement, indicating that the most promising area possibly lay in this direction. Boreholes N.S. 228-230 drilled in this direction some 20 chains ahead of mine workings, showed no appreciable improvement in the seams.

Thus no reserves have been established in Neath mine area.

NATURE OF COAL

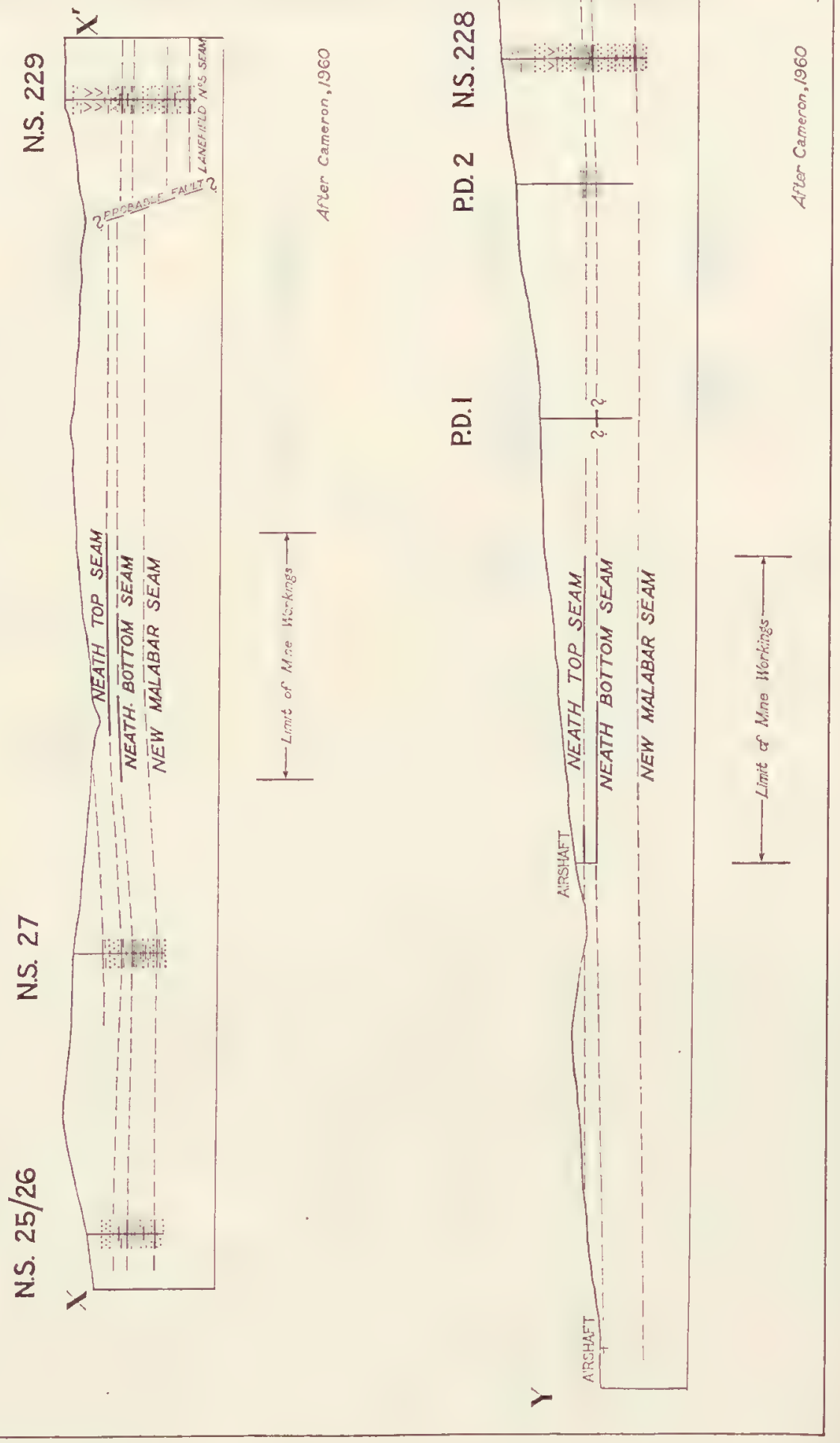
Sections of the Neath Top and Bottom seams, and of the New Malabar seam were analysed (see fig. 3), and the coal was found to be of high volatile bituminous rank. Fixed carbon, calculated on a dry, mineral-matter-free basis, ranges from 51·1 per cent. to 52·2 per cent. Calorific value, calculated on a moist, mineral-matter-free basis varies from 13,420 to 13,750 B.Th.U. per lb.

FIG.5

CROSS SECTIONS

NEATH — SUPPLEMENT

SCALE 10 0 10 20 Chains
500 0 500 1000 Feet



TPK. 1.3.62

CONCLUSIONS

Drilling in the north-east portion of Neath mine area has shown no marked improvement in the Neath Top and Bottom seams compared with the sections worked in the mine. Hence no reserves have been established.

The existence of a fault trending north-west–south-east with maximum vertical displacement of some 70 ft. and downthrow to the north-east is indicated.

REFERENCES

CAMERON, J. B., 1959: Coal resources—Rosewood-Walloon coalfield (Normanton No. 1 mine area). *Qld Govt Min. J., 60,* 254-262.

————, 1960: Coal resources—Rosewood-Walloon coalfield (Neath mine area). *Qld Govt Min. J., 61,* 585-589.

————, 1963: Coal resources, Rosewood-Walloon coalfield (New Malabar mine area). *Geol Surv. Qld. Publ.,* 312, 9-17.

HAWTHORNE, W. L., 1954: Coal resources—Rosewood-Walloon coalfield (Malabar mine area). *Qld Govt Min. J., 55,* 225-232.

MELLOR, B. D., (1953): Neath colliery. Unpub. rep. Geol. Surv. Qld.

13th March, 1962.

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GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

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JURASSIC SPORES AND POLLEN GRAINS FROM THE MARBURG SANDSTONE

By N. J. de JERSEY, Ph.D., M.Sc., Supervising Geologist

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1963

Preface

This paper by Dr. N. J. de Jersey is based on nine samples from the Marburg Sandstone of the type area. The investigation which it records forms part of the research programme of the Palynology Section on the major sedimentary formations of Queensland. Similar reports on microfloras from the Walloon and Ipswich Coal Measures have previously been published as G.S.Q. Publications Nos. 294 and 307, respectively. This work is providing a basis for age determination and correlation of sediments encountered in oil prospecting in the Artesian Basin. The particular significance of palynologic study of the Marburg Sandstone is apparent from the discovery of microfloral assemblages therein, similar to those from the Hutton Sandstone or "Upper Bundamba" of the Surat Basin. The correlation suggested thus provides evidence against applying the term "Bundamba" to strata in the Surat Basin. Further evidence on this subject will be furnished by an investigation of the Bundamba Sandstone of the type area, which is currently in progress.

A. K. DENMEAD,
Chief Government Geologist.

JURASSIC SPORES AND POLLEN GRAINS FROM THE MARBURG SANDSTONE

By N. J. DE JERSEY, Ph.D., M.Sc., Supervising Geologist

ABSTRACT

The investigation has been based on nine samples from the Marburg Sandstone of the type area. Thirty-three species of spores and pollen are recorded; of these three are proposed as new species, and four others as new combinations. Microfloral assemblages are recorded on the basis of percentage distribution, and comparisons made between them and assemblages from the Ipswich and Walloon Coal Measures. Evidence indicating a Lower Jurassic age for the formation is discussed and vertical changes in species distribution within the sequence are indicated. The paper is illustrated by three plates and a locality map.

1. INTRODUCTION

The Marburg Sandstone is a formation, conformably underlying the Walloon Coal Measures of the type area, from which it is distinguished by the greater maximum grain size of the sediments and by the absence of persistent, or workable, coal seams (Swindon 1960, pp. 287-291; Cameron 1962, p. 132). A distinctive feature is the presence of coarse, pebbly sandstones and conglomerates which are absent from the sediments of the Walloon Coal Measures. The palynological investigation recorded here has been carried out primarily to ascertain the differences and relationships between the microfloras of the two formations; additional objectives have been to provide further evidence on the age of the Marburg Sandstone and on correlation with sediments of equivalent age in the Artesian Basin. From the latter aspect, microfloral evidence suggests that sediments of equivalent age are present at many localities in the Artesian Basin, and the present work will thus provide a basis for future correlation studies.

2. NATURE OF SAMPLES STUDIED

The samples examined can be divided into three groups, as follows:—(*a*) Cores of shale, siltstone and coal from Bore N.S. 56, which was drilled by the Department of Mines in the United No. 8 Mine area of the Rosewood Coalfield to a depth of 877 ft. 10 in.; (*b*) Specimens of coal, carbonaceous shale and shale from the dump of the abandoned Glendale tunnel (near Lowood), in which was worked a thin seam in the lower part of the formation; and (*c*) Samples of cuttings from shallow holes drilled by the departmental "Proline" mechanical auger in the lower part of the formation, near Lowood. These localities are indicated on the Locality Map (Figure 1).

In bore N.S. 56 the top of the highest bed of pebbly sandstone, taken as the base of the Walloon Coal Measures, was encountered at 399 ft. 6 in. (Cameron 1962, p. 132), so that a vertical thickness of almost 480 ft. of the upper part of the Marburg Sandstone was penetrated. Five cores, from depths of 525 ft., 705 ft., 840 ft. 3¼ in., 853 ft. 3 in. and 877 ft., were examined, thus providing a sequence through the upper part of the formation.

Three samples, respectively of coal, carbonaceous shale and shale from the dump of the abandoned Glendale tunnel have been examined. The entrance to this tunnel (which was abandoned in 1933) is located on portion 203, parish of North, county of Churchill, approximately 1½ miles S.E. of Lowood Post Office. As the workings are no longer accessible, the precise stratigraphic position of the seam cannot be determined, but it is probable that it is less than 100 ft. above the lowest known outcrop of the Marburg Sandstone.

The third group of samples came from a series of shallow holes drilled by the "Proline" mechanical auger in the area adjacent to this abandoned tunnel. The purpose of the drilling was to provide unweathered samples of the sediments in this portion of the Marburg Sandstone, which would furnish knowledge of the microflora from an environment, less carbonaceous than that of the coal and associated shale of the colliery dump. This purpose was achieved, as although three of the holes penetrated only soil and weathered material, in a fourth hole drilled in a sandstone outcrop on the bank of the Brisbane River, unweathered sandstone and shale was recovered in the cuttings between 26 and 29 ft. The sample from between these depths yielded a diverse microflora, which is thus complementary to the assemblages from the coal and associated sediments.

3. EXPERIMENTAL METHOD

The writer has previously (de Jersey 1962, p. 1) described the technique used in maceration of coals. For samples of shale and siltstone, a different procedure has been employed, owing to the necessity of removing silica and silicate minerals. Such samples were first treated with dilute hydrochloric acid to remove calcium carbonate, then macerated by boiling for about 30 minutes in hydrofluoric acid solution at its constant boiling point concentration. The carbonaceous matter liberated was treated with Schulz

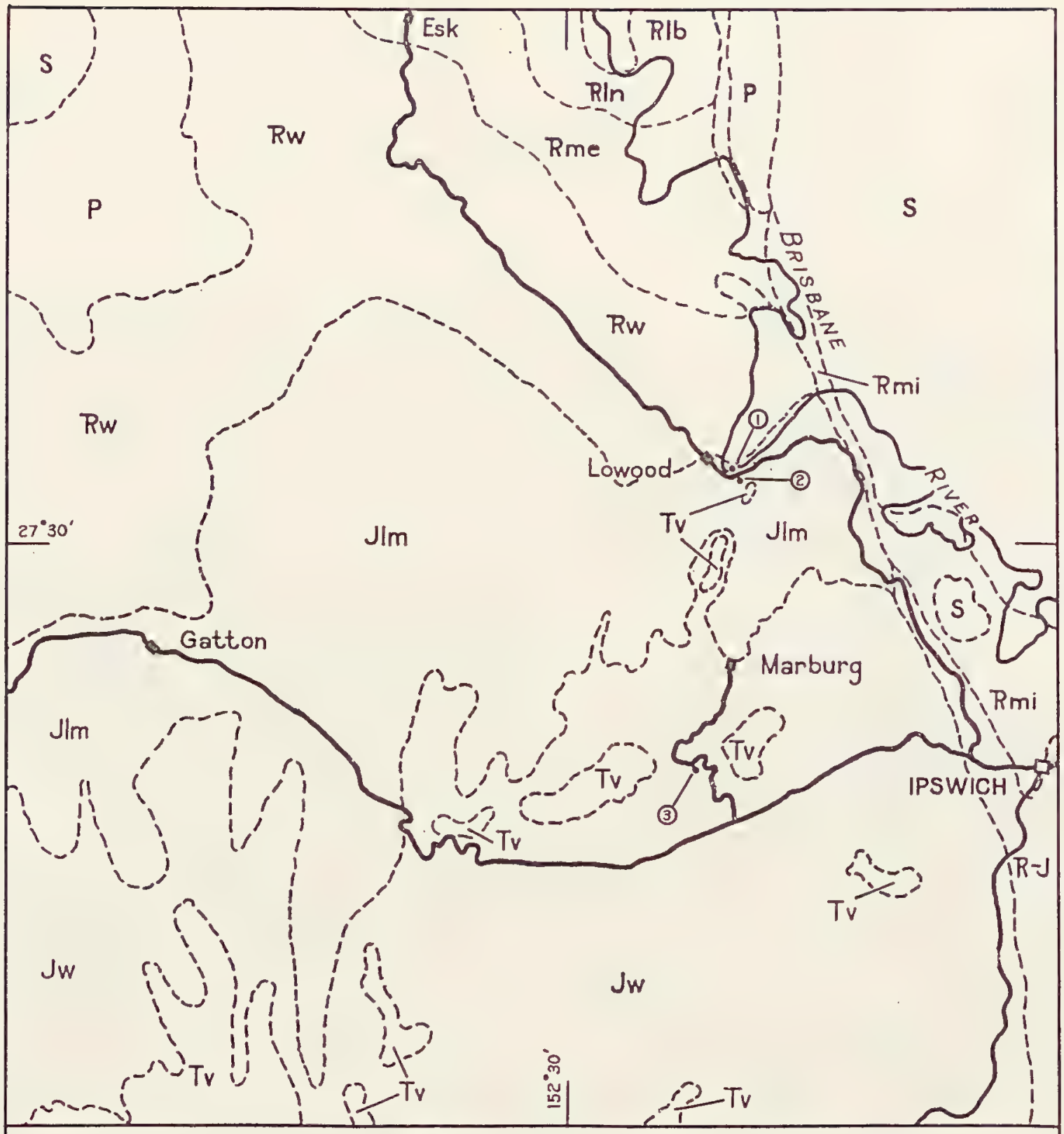


FIG. 1 SKETCH MAP OF SAMPLE LOCALITIES

TERTIARY	Tv	*Volcanic flows*
JURASSIC	Jw	*Walloon Coal Measures*
	Jlm	*Marburg Sandstone*
TRIASSIC – JURASSIC	R-J	*Undifferentiated sandstone*
TRIASSIC	Rw	*Wivenhoe Sandstone & equivalents*
	Rme	*Esk Shales*
	Rmi	*Ipswich Coal Measures*
	Rln	*Neara Volcanics.*
	Rlb	*Bryden Beds*
PERMIAN	P	*Undifferentiated*
? SILURIAN	S	*Neranleigh Fernvale Group & equivalents*

Scale of Miles
0 6 12

(After the Geological Map of the Moreton District. 1955)

SAMPLE LOCALITIES

① *Lowood "proline" drill hole.*
② *Glendale Colliery.*
③ *Drill hole N.S. 56.*

J.G. 14·2·1963

solution (potassium chlorate and concentrated nitric acid) for approximately two hours; and then finally with dilute sodium hydroxide solution. The residue was washed to neutrality after each stage of the process, using a centrifuge for this purpose.

The final maceration residue was mounted on microslides, using Canada balsam-xylol solution as the mounting medium. The micro-slides were traversed systematically with the aid of a mechanical stage, 500 specimens being examined for most of the samples. Specimens selected for photographing were located by means of their stage coordinates expressed to the nearest 0·1 mm. As mechanical stages are subject to considerable variation, as between different microscopes, the coordinates of an additional, easily located, reference point, selected as the lower right-hand corner of the cover glass of each slide, have been determined in each case. This reference point is quoted in the text, along with the coordinates of each holotype or figured specimen, so that with this information the specimens can be readily located by means of any microscope equipped with a mechanical stage. The micro-slides are stored in the palynological collection of the Geological Survey of Queensland, being numbered in the Rosewood coalfield section of the collection.

4. CLASSIFICATION OF SPORES AND POLLEN GRAINS

The spores and pollens recorded here have been described as genera and species on the basis of accepted taxonomic procedure. As indicated in a previous paper (de Jersey 1962, p. 2), the genera have been arranged, as far as possible, so as to indicate affinities with natural groups. Sufficient evidence is now available on the affinities of Jurassic microfloras for a tentative step to be taken in this direction, although much further work will be necessary to elucidate the affinities of all species in the microflora.

5. SYSTEMATIC DESCRIPTIONS

? Fungal Spores

Genus INAPERTISPORITES van der Hammen ex Rouse

Inapertisporites minutus (de Jersey)

Plate 1, Figure 1

Pilasporites minutus de Jersey, 1959, Qld Govt Min. J. **60**, 359, pl. 2, fig. 11.

Inapertisporites minutus (de Jersey), 1962, Geol. Surv. Qld Publ., **307,** pl. 1, figs. 1, 2.

Diagnosis (de Jersey 1962, p.2):—Outline circular or sub-circular. No germinal mechanism visible. Diameter (based on 131 measured specimens) 7 to 20 microns. Exine smooth, one micron or less in thickness.

Remarks.—The specimens recorded here are closely similar to those previously described from the Ipswich and Walloon Coal Measures.

Figured specimen (Plate 1, Figure 1).—Slide No. 414, Stage coordinates 12·75, 119·1; diameter 14 microns. Coordinates of lower right-hand corner of cover glass 2·55, 122·5.

Inapertisporites crassus (de Jersey)

Plate 1, Figure 2

Pilasporites crassus de Jersey, 1959, Qld Govt Min. J., **60**, 359, pl. 2, fig. 12.

Inapertisporites crassus (de Jersey), 1962, Geol. Surv. Qld Publ., **307,** 2, pl. 1, figs. 3, 4, 5.

Diagnosis (de Jersey 1962, p. 2).—Outline circular or sub-circular. No germinal mechanism normally visible; a few specimens exhibit thinner regions of the spore wall suggestive of germinal apertures. Diameter (based on 30 measured specimens) 7 to 22 microns. Exine smooth, thick walled or deeply pigmented, appearing dark brown in transmitted light.

Remarks.—The specimens recorded here are closely similar to those previously recorded from the Ipswich and Walloon Coal Measures.

Figured specimen (Plate 1, Figure 2).—Slide No. 441, Stage coordinates 19·0, 114·4; diameter 18 microns. Coordinates of lower right-hand corner of cover glass 2·75, 120·0.

Division BRYOPHYTA
Class MUSCI
Family SPHAGNACEAE
Genus SPHAGNUMSPORITES Raatz

Sphagnumsporites adnatus de Jersey

Diagnosis (de Jersey 1962, p. 3).—Amb rounded triangular to sub-circular. Trilete, laesurae extending about two-thirds the distance to the periphery. Diameter (based on 68 measured specimens) 21 to 42 microns. Contact area marked by a proximal sub-triangular to circular thickening of the exine, normally extending to ends of laesurae. Diameter of contact area 13 to 26 microns. Exine smooth, thickness 1 to 3 microns.

Remarks.—The specimens of this species are similar to those described by the writer from the Ipswich and Walloon Coal Measures (de Jersey 1962, p. 3; 1959, p. 348) and do not add anything to those previous descriptions.

Sphagnumsporites tenuis de Jersey

Diagnosis (de Jersey 1959, p. 348).—Amb rounded triangular to sub-circular. Trilete, laesurae extending to, or almost to, the periphery. Diameter (based on 33 measured specimens) 20 to 40 microns. Exine smooth, about 1 micron in thickness.

Remarks.—The spores recorded here are closely comparable with those previously described from the Ipswich and Walloon Coal Measures (de Jersey 1962, p. 3; 1959, p. 348).

Division LYCOPODOPHYTA
Order LYCOPODIALES
Family LYCOPODIACEAE
Genus LYCOPODIUMSPORITES Thiergart

Lycopodiumsporites rosewoodensis (de Jersey), new combination

Plate 1, Figure 3

Lycopodium rosewoodensis de Jersey, 1959, Qld Govt Min. J., **60**, 353, pl. 1, figs. 5, 6.

Diagnosis (de Jersey 1959, p. 353).—Amb sub-circular. Trilete, indistinct laesurae, extending to the periphery. Diameter (based on 81 measured specimens) 25 to 46 microns. Exine about 1 micron thick, ornamented on the distal side by a regular polygonal reticulum, lumina 2 to 8 microns in diameter (average 4 microns), muri 1 micron wide, 1 to 2 microns in height at the spore margin. Equatorial flange absent.

Remarks.—This species, previously placed in *Lycopodium,* is here transferred to the more appropriate genus *Lycopodiumsporites,* which, being a form-genus, does not imply generic identity with the living *Lycopodium.* The specimens recorded here from the Marburg Sandstone are similar in all respects to those previously described from the Walloon Coal Measures.

Figured specimen (Plate 1, Figure 3).—Slide No. 408, Stage coordinates 6·15, 108·0; diameter 38 microns. Coordinates of lower right-hand corner of cover glass 2·0, 124·8.

Lycopodiumsporites sp.

Plate 1, Figure 4

Description.—Amb circular or sub-circular. Spore complex, consisting of a sub-circular central body surrounded by an equatorial cingulm. Trilete, laesurae indistinct, where evident extending to the periphery of the central body. Total diameter (based on 7 measured specimens) 30 to 49 microns. Central body (diameter 25 to 42 microns) ornamented with an indistinct, irregular, polygonal reticulum, lumina 3 to 8 microns (average 6 microns), muri about 1·5 microns wide, 1·5 microns high. Body light brownish-yellow to light brown, about 1·5 microns in thickness. Cingulum 3 to 6 microns wide, with some radiating folds, colourless, less than 1 micron in thickness.

Remarks.—The spores recorded here are of similar general construction to *L. austroclavatidites* Cookson (Cookson 1953, p. 469), but differ from that species in having less distinct laesurae, a less distinct reticulum and narrower muri. Insufficient specimens have been found to enable assessment of the range in variation in diagnostic characters, so that recognition of these spores as a distinct new species must await study of further material.

Figured specimen (Plate 1, Figure 4).—Slide No. 369, Stage coordinates of lower right-hand corner of cover glass 14·5, 108·6; total diameter 42 microns. Coordinates of lower right-hand corner of cover glass 14·5, 108·6.

Division PTEROPHYTA
Class FILICOPSIDA
Order FILICALES
Family OSMUNDACEAE
Genus OSMUNDACIDITES Couper

Remarks.—In the Triassic of the Ipswich Coal Measures spores referred to this genus are relatively small (28 to 39 microns) and have recently been separated as a new species *O. parvus* (de Jersey 1962, p. 4) from *O. wellmanii* Couper (40 to 63 microns). This separation was supported by the absence of larger forms from the Ipswich microflora. In the Walloon Coal Measures, on the other hand, the spores are mostly large forms comparable with *O. wellmanii,* and specimens less than 40 microns are rare. In the Marburg Sandstone which, stratigraphically, occupies an intermediate position, there is an intermingling of both small and large forms, and the arbitrary course has been followed of placing specimens larger than 40 microns in diameter in *O. wellmanii* and those smaller than 40 microns in *O. parvus.*

Osmundacidites wellmanii Couper

Plate 1, Figure 6

Diagnosis (Couper 1953, p. 20).—Free, anisopolar, trilete, laesurae moderately long, occasionally rather indistinct. Spherical to sub-spherical. Exine thin, c. 1.5 microns, granular-papillate, sculpture reduced to granular or finely granular in the region of the tetrad scar. Size range 40-(60)-63 microns in equatorial diameter.

Figured specimen (Plate 1, Figure 6).—Slide No. 369, Stage coordinates 10·95, 117·3; diameter 49 microns. Coordinates of lower right-hand corner of cover glass 3·9, 122·9.

Osmundacidites parvus de Jersey

Plate 1, Figure 5

Diagnosis (de Jersey 1962, p. 4).—Amb circular or sub-circular. Trilete, well defined laesurae, extending to, or almost to, the periphery. Diameter (based on 20 measured specimens) 28 to 39 microns. Exine about 1 micron thick, pale yellow or light yellow, frequently folded, with folds of an arcuate nature.

Ornamentation granular-papillate, with projections 0·5 to 1 micron in diameter, set about 1 micron apart. No marked reduction of ornament in proximal region.

Figured specimen (Plate 1, Figure 5).—Slide No. 366, Stage coordinates 14·0, 107·6; diameter 34 microns. Coordinates of lower right-hand corner of cover glass 1·9, 120·3.

(All photographs approximately 850 diameters)

PLATE 1

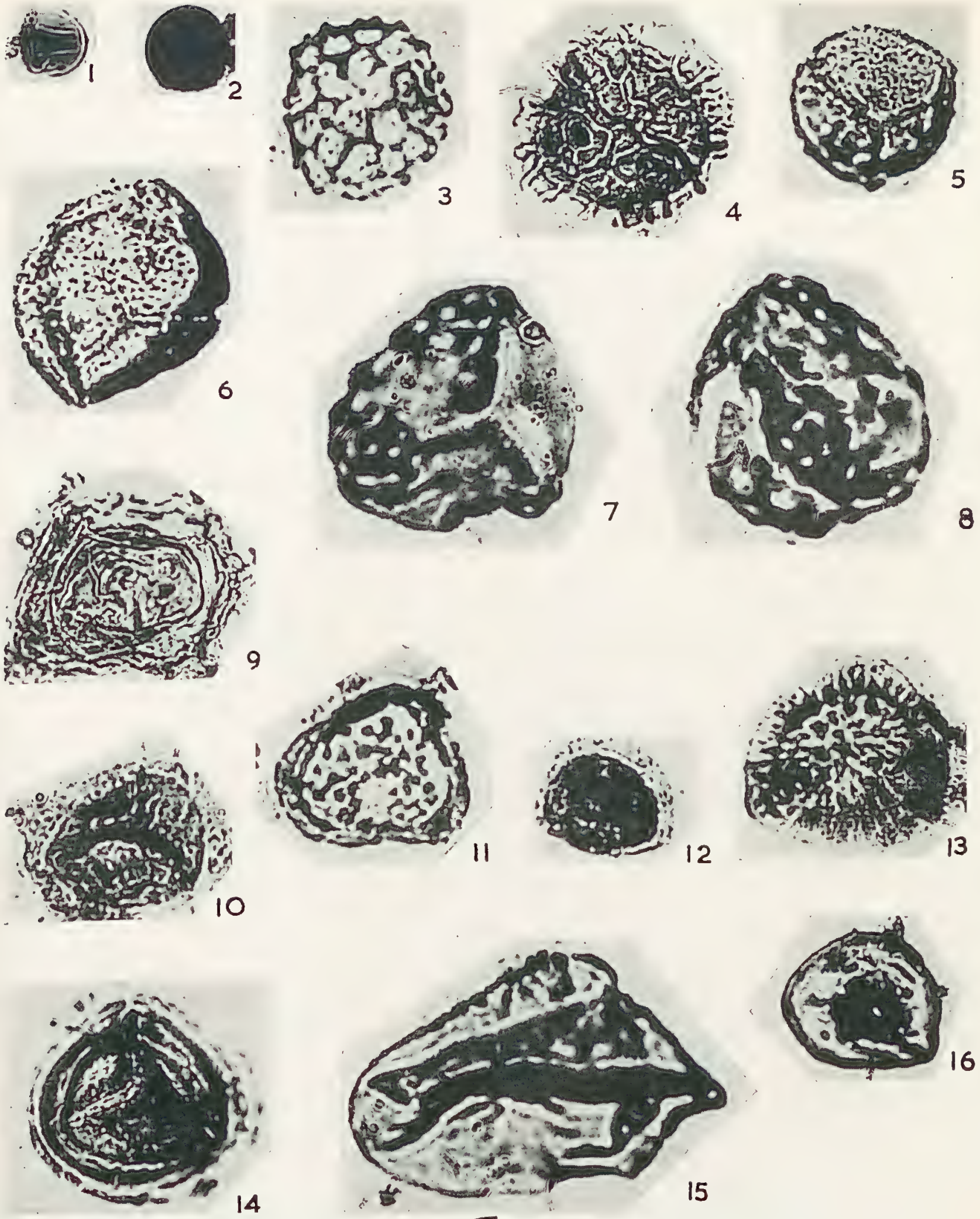


Figure 1—*Inapertisporites minutus* (de Jersey)
Figure 2—*Inapertisporites crassus* (de Jersey)
Figure 3—*Lycopodiumsporites rosewoodensis* (de Jersey), n. comb.
Figure 4—*Lycopodiumsporites sp.*
Figure 5—*Osmundacidites parvus* de Jersey
Figure 6—*Osmundacidites wellmanii* Couper
Figure 7—*Ischyosporites marburgensis,* new species (Holotype)
Figure 8—*Ischyosporites marburgensis,* new species
Figure 9—*Perotriletes tenuis,* new species (Holotype)
Figure 10—*Perotiletes tenuis,* new species
Figure 11—*Cingulatisporites granulatus* de Jersey
Figure 12—*Perotriletes tenuis,* new species
Figure 13—*Cingulatisporites granulatus* de Jersey
Figure 14—*Taurocusporites sp.* cf. *T. triangularis* (Bolkhovitina) Stover (Proximal focus)
Figure 15—*Leiotriletes magnus* de Jersey
Figure 16—*Annulispora microannulata* de Jersey

SPORES—INCERTAE SEDIS

Genus LEIOTRILETES (Naumova) Potonié and Kremp

Leiotriletes directus Balme and Hennelly

Remarks.—Nothing can be added to previous records of this species (de Jersey 1962, p. 4; 1959, p. 354).

Leiotriletes magnus de Jersey, emend.

Plate 1, Figure 15

Emended diagnosis.—Amb triangular, sides straight or slightly convex in polar view. Trilete, laesurae poorly to well defined, extending to, or almost to, the periphery. Diameter (based on 25 measured speciments) 41 to 65 microns. Exine thin (about 1 micron), smooth, subject to folding during compression.

Remarks.—The specific diagnosis is here emended slightly to include speciments with poorly defined laesurae, often obscured by folding, which are otherwise similar to those previously described from the Walloon Coal Measures (de Jersey 1959,) p. 354).

Figured specimen (Plate 1, Figure 15).—Slide No. 402, Stage coordinates 15·0, 104·3; diameter 63 microns. Coordinates of lower right-hand corner of cover glass 1·3, 120·5.

Genus CONCAVISPORITES (Pflug) Delcourt and Sprumont

Concavisporites mortoni (de Jersey)

Diagnosis (de Jersey 1962, p. 4).—Amb triangular, apices rounded, sides straight, slightly concave or convex. Trilete, laesurae distinct, extending almost to the periphery, bordered by three ridges (tori), 2 to 5 microns in width, concave towards the equator, sometimes joining around the ends of the laesurae. Diameter (based on 57 measured specimens) 20 to 40 microns. Exine 1 to 1·5 microns thick, smooth, pale yellow to light brownish yellow.

Remarks.—The specimens from the Marburg Sandstone do not add anything to previous knowledge of this species.

Genus GRANULATISPORITES (Ibrahim) Potonié and Kremp

Granulatisporites minor de Jersey

Diagnosis (de Jersey 1962, p. 5)—Amb triangular, sides straight or slightly convex in polar view. Trilete, laesurae indistinct, extending to the periphery. Diameter (based on 44 measured specimens) 17 to 45 microns. Exine about 1 micron thick, ornamented with small, closely packed granulations (diameter about 1 micron); ornamentation becoming slightly papillate at the periphery.

Remarks.—The specimens recorded are specifically indistinguishable from those previously described from the Ipswich and Walloon Coal Measures, and do not add to previous descriptions.

Genus ANNULISPORA de Jersey

Annulispora folliculosa (Rogalska) de Jersey

Diagnosis (de Jersey 1959, p. 358).—Amb circular or rounded triangular. Trilete, laesurae distinct, of variable length (average length about two-thirds of the spore radius). Diameter (based on 103 measured specimens) 23 to 48 microns. Exine smooth, or faintly roughened, about 2 to 3 microns thick. The distal portion of the spore wall exhibits a thickened sub-circular ring of exine, about 2 to 5 microns in width, with a sharp inner boundary, and a more gradual demarcation from the outer portion of the spore body. Internal diameter of ring 7 to 17 microns.

Holotype (here selected).—Specimen figured by Rogalska, Inst. Geol. Bull. 89 (Warsaw), pl. XII, fig. 8.

Remarks.—In the original description of this species (Rogalska 1954, pp. 26, 44) no holotype was indicated. This omission is now rectified by selecting the specimen figured in Rogalska's paper. The species is relatively rare in the Marburg Sandstone, being much more common in the overlying Walloon Coal Measures.

Annulispora microannulata de Jersey

Plate 1, Figure 16

Diagnosis (de Jersey 1962, p. 5).—Amb subcircular. Trilete, laesurae distinct, extending about two-thirds of the spore radius. Diameter (based on 20 measured specimens) 25 to 45 microns. Exine smooth, 1·5 to 3 microns thick at equator. Distant portion of the spore wall with a sub-circular ring of thickened exine, average width 5 microns. Internal diameter of ring 2 to 4 microns, external diameter 8 to 17 microns.

Remarks.—The occurrence of this species in the Marburg Sandstone extends its range upwards from the Ipswich Coal Measures, from which it was originally described. Its relative rarity in the samples recorded here suggests that they represent horizons near the upper limit of its range, as it has not been found in the overlying Walloon Coal Measures.

Figured specimen (Plate 1, Figure 16).—Slide No. 373, Stage coordinates 18·5, 107·6; diameter 31 microns. Coordinates of lower right-hand corner of cover glass 2·5, 120·6.

Genus LEPTOLEPIDITES Couper

Leptolepidites verrucatus Couper

Remarks.—This species is relatively rare in the Marburg Sandstone, and the specimens recorded here do not add to previous knowledge, based on material from the Jurassic of New Zealand (Couper 1953, p. 28) and from the Walloon Coal Measures (de Jersey 1959, p. 354).

Genus ISCHYOSPORITES Balme

Ischyosporites marburgensis, new species

Plate 1, Figures 7 and 8

Diagnosis.—Amb triangular to sub-triangular, sides straight or slightly convex, apices rounded. Trilete, distinct laesurae reaching almost to the

periphery of the proximal face, without any marked development of lips or commissure. Diameter (based on 25 measured specimens) 45 to 70 microns. Exine 2·5 to 5 microns thick, slightly thicker at the apices. Distal face ornamented with ridges anastomosing to form a fairly regular reticulum with oval to sub-circular lumina 2 to 6 (mostly 3 to 4) microns in diameter separated by muri about 3 microns in width. Proximal face with reduced ornament.

Remarks.—*I. marburgensis* differs from the genotype *I. crateris* (Balme 1957, p. 23) in having a thinner and more evenly thickened exine and smaller lumina. It is also distinguishable from *I. scaberis* Cookson and Dettman, which has a more rounded outline and a proximal surface ornamented with coarse granules, and from *I. punctatus* Cookson and Dettman, which has fine pitting on the proximal surface, in the vicinity of the tetrad scar.

Holotype (Plate 1, Figure 7).—Slide No. 401, Stage coordinates 11·3, 118·0; diameter 59 microns. Coordinates of lower right-hand corner of cover glass 3·15, 121·1.

Locality of holotype.—Bore N.S. 56 (Rosewood Coalfield), 525 ft.

Figured specimen (Plate 1, Figure 8).—Slide No. 405, Stage coordinates 3·4, 107·8; diameter 53 microns. Coordinates of lower right-hand corner of cover glass 2·25, 120·95.

Genus TAUROCUSPORITES Stover

Taurocusporites sp. cf. T. triangularis (Bolkhovitina) Stover

Plate 1, Figure 14; Plate 2, Figures 1 and 2

Description.—Amb circular or sub-circular. Diameter (one specimen) 46 microns. Trilete, laesurae extending almost to equatorial margin, bordered by prominent, slightly raised, dark labra (lips), 3 microns in width. Distal face trizonate, ornamented by three concentric zones of thickening, separated by two thinner portions of exine. Thickened zones consisting of a central sub-circular area approximately at the distal pole, about 17 microns in diameter, with two outer concentric rings 4 to 6 microns in width. Intervening areas 3 to 4 microns (inner) and 1·5 to 2 microns wide (outer). Thin marginal portion, about 3 microns wide, surrounding outer thickened ring. Exine otherwise smooth, light brownish yellow to dark brown.

Remarks.—Although only one specimen has been found, the discovery of this genus in the Jurassic of Queensland is of considerable interest. The specimen described is similar to *T. triangularis* (Bolkhovitina) Stover in size, shape, in having prominent labra (Proximal focus—Plate 1, Figure 14), and also in having distinctly separated (not imbricating) zones of distal thickening (Plate 2, Figures 1 and 2—Distal focus). It differs from illustrations of that species (Bolkhovitina 1956, figs. 98*a*, 98*b*) in that the thickened zones are not so widely separated, although some variation is evident in this respect in Bolkhovitina's figures. It also differs, perhaps more significantly, in having a thin outer marginal portion of exine which is not indicated in figures of the Russian specimens. Further specimens will be necessary to assess the range of variation of the Queensland spores in these two features, and, consequently, as only one specimen is available, it is only compared with *T. triangularis* at this stage.

Figured specimen (Plate 1, Figure 14—Proximal focus; Plate 2, Figure 1—Distal focus (Exposed for thickened rings); Plate 2, Figure 2—Distal focus (Exposed for thin equatorial portion)).—Slide No. 433, Stage coordinates 3·25, 114·1; diameter 46 microns. Coordinates of lower right-hand corner of cover glass 1·5, 125·6.

Genus CINGULATISPORITES Thomson

Cingulatisporites granulatus de Jersey

Plate 1, Figures 11 and 13

Diagnosis (de Jersey 1959, p. 357).—Amb rounded triangular to sub-circular. Spore complex, consisting of a central body surrounded equatorially by a hyaline cingulum 3 to 6 microns wide. Trilete, laesurae extending to the junction of the central body and cingulum. Total diameter (based on 10 measured specimens) 33 to 50 microns; diameter of body 27 to 37 microns. Exine 1 to 2 microns thick, proximal side smooth, distal face granulate-echinate, ornamented by closely-packed granulate to bluntly spinose projections 1 to 3 microns in length and 1 to 2 microns in basal diameter. Cingulum smooth.

Remarks.—Some variation has been observed in ornamentation of the Marburg specimens of this species, there being a gradation from specimens similar to the holotype, with granules or small verrucae 2 to 3 microns in diameter (Plate 1, Figure 11) to those with longer spines (up to 4 microns in length) (Plate 1, Figure 13). The latter approach *C. saevus* Balme, described from the Upper Jurassic of Western Australia (Balme 1957, p. 26). However none of the projections reach a length of 7 microns, as quoted by Balme, and the average size of the projections is appreciably smaller than the average for those of *C. saevus,* on the basis of Balme's figures of that species. Accordingly, until further evidence is available, the two species are regarded as distinct. The stratigraphic evidence available supports this conclusion, as there is no indication of continuity of range for *C. saevus* from its Upper Jurassic occurrences (in Western Australia) down to Lower Jurassic horizons, represented by assemblages from the Marburg Sandstone.

Regarding the generic identification of *C. granulatus,* the morphology of *Cingulatisporites* has recently been discussed by Pocock (1961, p. 1234). The writer is in agreement with Pocock's re-definition of the term "cingulum" (1961, p. 1235); on this basis examination of the holotype of *C. granulatus* shows that it is truly cingulate, possessing a cingulum which fits this defintiion. In this respect there are thus no grounds for excluding *C. granulatus* from *Cingulatisporites.* However Pocock in his re-statement of the generic diagnosis describes the exine as "smooth,

scabrate or granulose, never strongly ornamented" and possibly the more coarsely ornamented specimens of *C. granulatus* might be excluded from the genus on the grounds of excessively coarse ornamentation. In view of the continuous gradation of ornament from granulose to coarsely spinose shown by specimens of this species the writer considers that the exclusion of "strongly ornamented" spores from the genus may be difficult to effect in practice. As a result he is inclined to interpret the genus somewhat more broadly and so to retain this species in *Cingulatisporites*.

Figured specimen (Plate 1, Figure 11).—Slide No. 366, Stage coordinates 10·1, 116·8; diameter 38 microns. Coordinates of lower right-hand corner of cover glass 1·9, 120·3.

Figured specimen (Plate 1, Figure 13).—Slide No. 369, Stage co-ordinates 8·4, 110·8; diameter 39 microns. Coordinates of lower right-hand corner of cover glass 3·9, 122·9.

Genus PEROTRILETES Couper

Perotriletes tenuis, new species

Plate 1, Figures 9, 10 and 12

Diagnosis.—Spore consisting of a central exine enclosed by a distinct perispore. Diameter (including perispore) 25 to 50 microns (based on 38 measured specimens). Exine trilete, laesurae inconspicuous (not evident in many specimens). Exine thin, frequently folded (one micron or less), smooth to finely scabrate, light yellow to brownish yellow, diameter 17 to 36 microns, outline sub-triangular to sub-circular. Perispore very thin (less than 1 micron), smooth to scabrate, peripheral outline sub-triangular to sub-circular, colourless or pale yellow, extending about 4 to 11 microns beyond margin of exine.

Remarks.—*P. tenuis* is distinguished from previously described species of the genus by its small size, inconspicuous laesurae, thin perispore and lack of marked ornamentation. It is a distinctive component of some assemblages from the Marburg Sandstone, and from available evidence, appears to be restricted in range to horizons within the formation.

Holotype (Plate 1, Figure 9).—Slide No. 437, Stage coordinates 5·2, 116·8; total diameter 48 microns. Coordinates of lower right-hand corner of cover glass 2·4, 122·0.

Locality of holotype.—Cuttings from 26 to 29 ft., Proline hole, south bank of Brisbane River at northern end of Portion 203, parish of North, county of Churchill.

Figured specimen (Plate 1, Figure 10).—Slide No. 407, Stage coordinates 14·5, 105·7; total diameter 39 microns. Coordinates of lower right-hand corner of cover glass 1·8, 118·4.

Figured specimen (Plate 1, Figure 12).—Slide No. 408, Stage coordinates 7·4, 111·5; total diameter, 28 microns. Coordinates of lower right-hand corner of cover glass 2·0, 124·8.

? Division PTERIDOSPERMOPHYTA
? Family CORYSTOSPERMACEAE
Genus ALISPORITES (Daugherty) Rouse

Alisporites sp.

Plate 2, Figures 4, 5, 7 and 8

Remarks.—The specimens figured have the typical opposite attachment and lack of marked distal inclination of the sacci which characterise *Alisporites*. Pollens of *Alisporites* from the Ipswich Coal Measures closely resemble those from the microsporangia of *Pteruchus* and the writer (de Jersey 1962, pp. 8, 9) has described a species *A. australis* with grains closely resembling those of *Pteruchus johnstoni* (Feistmantel) Townrow. Other types of pollen comparable with *Pteruchus simmondsi* and *Pteruchus dubius* have been recorded respectively as *Alisporites* sp. 1 and *Alisporites* sp. 2 (de Jersey 1962, p. 9).

The pollen grains from the Marburg Sandstone recorded here, although regarded as having probable affinities with *Pteruchus,* have not been differentiated specifically because of their generally poor preservation and relative rarity in the samples examined.

Figured specimen (Plate 2, Figure 4).—Slide No. 404, Stage coordinates 14·0, 113·0; total span 95 microns. Coordinates of lower right-hand corner of cover glass 2·1, 119·7.

Figured specimen (Plate 2, Figure 5).—Slide No. 390, Stage coordinates 11·1, 114·1; total span 98 microns. Coordinates of lower right-hand corner of cover glass 2·1, 116·8.

Figured specimen (Plate 2, Figure 7).—Slide No. 388, Stage coordinates 6·0, 110·3; total span 76 microns. Coordinates of lower right-hand corner of cover glass 1·7, 120·35.

Figured specimen (Plate 2, Figure 8).—Slide No. 402, Stage coordinates 6·6, 112·8; total span 70 microns. Coordinates of lower right-hand corner of cover glass 1·35, 120·1.

Division PTERIDOSPERMOPHYTA
Family CAYTONIACEAE
Genus VITREISPORITES Leschik

Vitreisporites contectus (de Jersey)

Diagnosis (de Jersey 1962, p. 10).—Pollen grains disaccate. Corpus oval in polar view, longer than broad, exine smooth, very thin (less than 1 micron). Total span of grain (based on 73 measured specimens) 22 to 47 microns; length of corpus 15 to 32 microns, breadth of corpus 13 to 28 microns, average ratio of length to breadth 1·2. Sacci large in relation to size of corpus, attached with a slight distal inclination. Sacci covering corpus except for a narrow median longitudinal portion, 1 to 2 microns in width, extending complete length of corpus. Sacci smooth or with faint reticulate ornament, less than 1 micron in thickness.

Remarks.—This species is relatively rare in samples from the Marburg Sandstone and the specimens found do not add anything to previous knowledge, based on material from the Ipswich and Walloon Coal Measures.

Vitreisporites subtilis (de Jersey)

Diagnosis (de Jersey 1962, p. 11).—Pollen grains disaccate. Corpus oval in polar view, longer than broad, exine smooth, very thin (less than 1 micron). Total span of grain (based on 59 measured specimens) 22 to 48 microns, length of corpus 14 to 30 microns, breadth of corpus 12 to 28 microns, average ratio of length to breadth 1·2. Sacci about same size as corpus, opposite or attached with slight distal inclination. Sacci overlapping corpus except for a median portion 5 to 15 microns in width, extending length of corpus. Sacci smooth to faintly reticulate (mesh 1 micron or less), less than 1 micron in thickness.

Remarks.—This species is distinguished from *V. signatus* Leschik, of which *Caytonipollenites pallidus* (Reissinger) is a synonym, by the lack of marked saccus ornamentation. This lack of marked saccus ornamentation is a feature of specimens of *V. subtilis* from the Ipswich and Walloon Coal Measures. Should further study of these Mesozoic pollens show that this character is a variable one, it would be necessary to unite *V. subtilis* with *V. signatus*. Unfortunately as *Vitreisporites* is not common in the samples examined from the Marburg Sandstone, it has not been possible to explore the range of variation. Consequently, on evidence available at present, and pending further study of additional material, the species are regarded as distinct.

Monocolpate Pollen Grains

Remarks.—Under this heading are included pollen grains, more or less oval in outline, with a single longitudinal furrow or colpus, such as are produced by the Ginkgoales, Cycadophyta and some Pteridosperms. Because of the generalised nature of these grains, the species described below should be regarded as form-species, and are likely to include more than one natural species.

Genus GINKGOCYCADOPHYTUS Samoilowitz

Ginkgocycadophytus nitidus (Balme) de Jersey

Diagnosis (de Jersey 1962, p. 12).—Amb elongated oval to broadly oval. Monocolpate, furrow extending full length of the distal surface, uniform in width or slightly expanded at the extremities. Length (based on 145 measured specimens), 20 to 55 microns, breadth 11 to 36 microns. Exine smooth or faintly scabrate, 1 micron less in thickness.

Remarks.—The Marburg specimens are similar to those from the Ipswich and Walloon Coal Measures and nothing can be added to previous accounts of the species (de Jersey 1962, p. 12; 1959, p. 359; Balme 1957, p. 30).

Ginkgocycadophytus magnus (de Jersey), new combination

Plate 3, Figure 4

Entylissa magna de Jersey, 1959, Qld. Govt. Min. J. **60,** 361, pl. 3, fig. 1.

Diagnosis (de Jersey 1959, p. 361).—Amb elongated oval, monocolpate, furrow extending full length of distal face without conspicuous development of furrow margins. Length (based on 38 measured specimens) 60 to 110 microns, width 27 to 66 microns. Exine smooth, 1 to 2 microns in thickness.

Remarks.—The writer has discussed previously (de Jersey 1962, p. 12) the reasons for preferring *Ginkgocycadophytus* to *Entylissa* as a generic name for these pollen grains. Accordingly *Entylissa magna* de Jersey 1959 is here transferred to *Ginkgocycadophytus*. The specimens from the Marburg Sandstone resemble closely those from the Walloon Coal Measures, on which the species was originally based.

Figured specimen (Plate 3, Figure).—Slide No. 353, Stage coordinates 13·1, 111·9; dimensions 76 x 34 microns. Coordinates of lower right-hand corner of cover glass 2·7, 119·9.

Division CONIFEROPHYTA
Family ARAUCARIACEAE
Genus ARAUCARIACITES Cookson ex Couper

Araucariacites sp.

Plate 2, Figure 3.

Remarks.—Of the specimens recorded here the better preserved examples are distinguished from *A. australis* Cookson, originally described from the Tertiary of Kerguelen (Cookson 1947, p. 130), by having granulations which are larger and also more distinctly separated. In diameter the Marburg specimens range from 39 to 91 microns, having granular to papillate projections 0·5 to 1·5 microns in basal width, with an exine thickness about 1 to 1·5 microns. While these pollens are thus regarded as different from Cookson's species, insufficient well preserved specimens have been found to permit detailed study of the range in variation of diagnostic features, and consequently recognition as a distinct new species is not warranted at this stage.

Figures specimen (Plate 2, Figure 3).—Slide No. 389, Stage coordinates 12·9, 108·5; diameter 81 microns. Coordinates of lower right-hand corner of cover glass 2·8, 121·6.

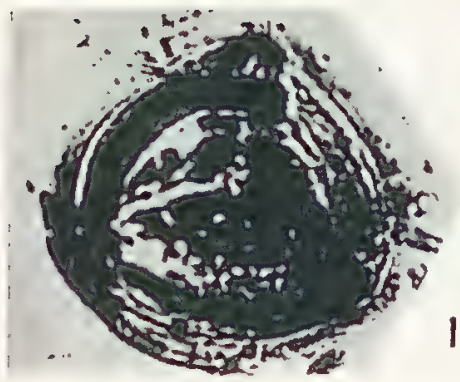
Division CONIFEROPHYTA
Genus LARICOIDITES Potonié, Thomson and Thiergart

Laricoidites reidi (de Jersey)

Diagnosis (de Jersey 1959, p. 362).—Outline circular or subcircular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Diameter (based on 156 measured specimens) 60 to

(All photographs approximately 850 diameters)

PLATE 2



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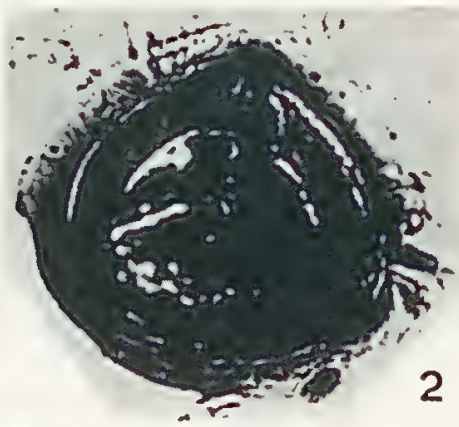

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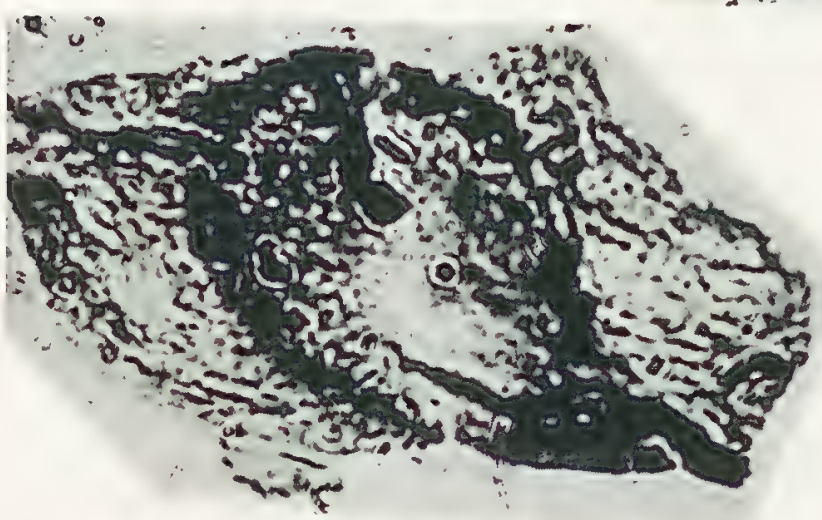

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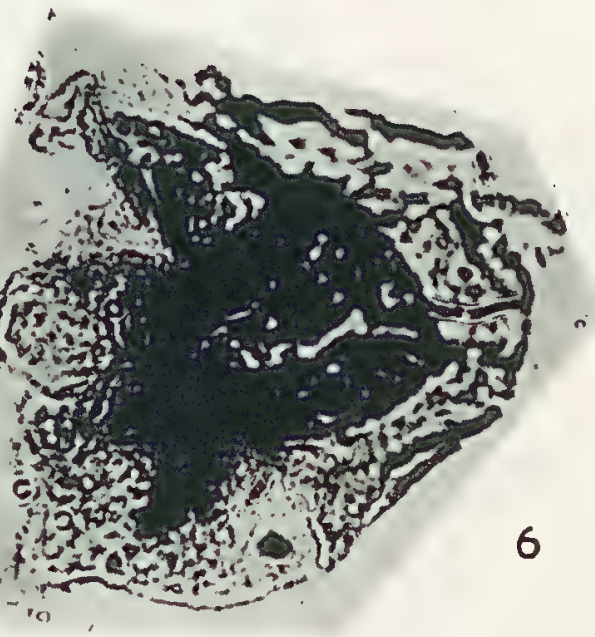

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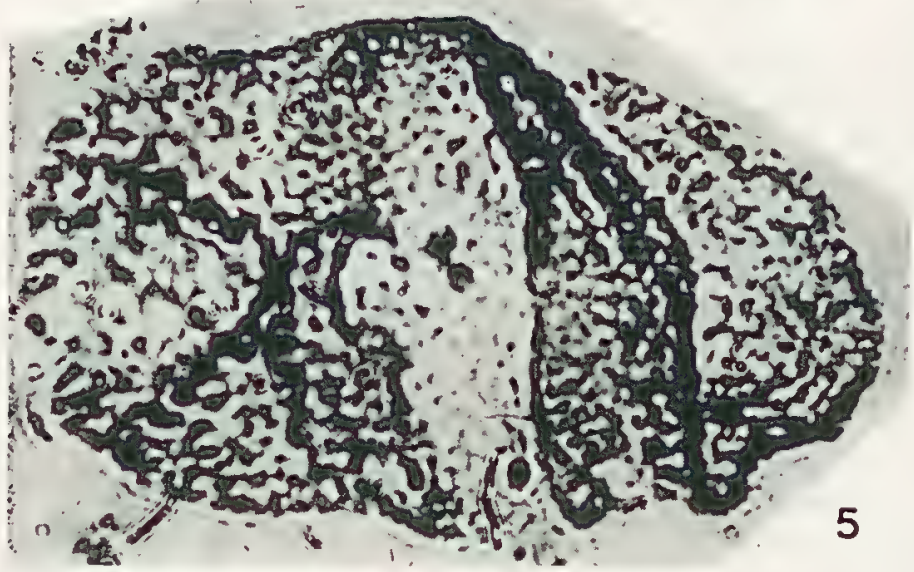

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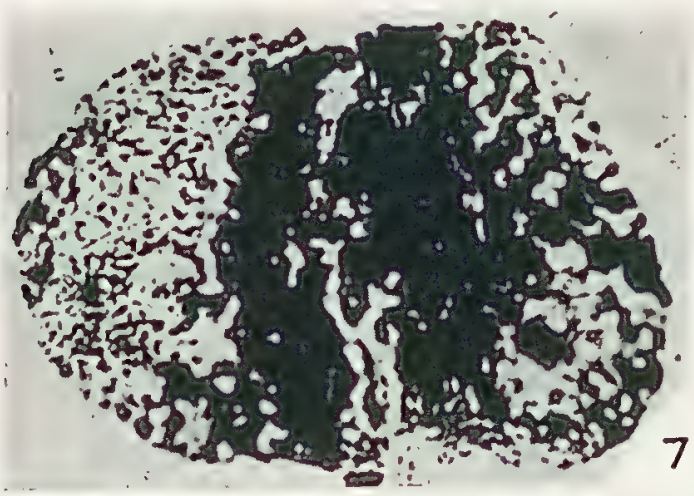

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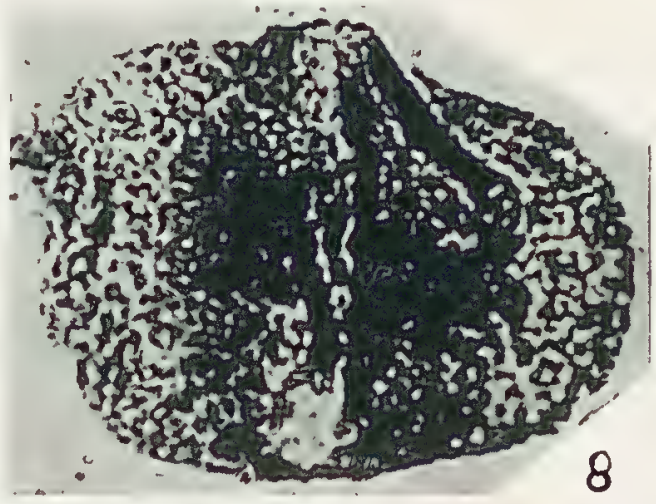

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Figure 1—*Taurocusporites sp.* cf. *T. triangularis* (Bolkhovitina) Stover (Distal focus: exposed for thickened rings)

Figure 2—*Taurocusporites sp.* cf. *T. triangularis* (Bolkhovitina) Stover (Distal focus; exposed for thin equatorial portion).

Figure 3—*Araucariacites sp.*

Figure 4—*Alisporites sp.*

Figure 5—*Alisporites sp.*

Figure 6—*Laricoidites turbatus* (Balme), n. comb.

Figure 7—*Alisporites sp.*

Figure 8—*Alisporites sp.*

112 microns (average about 82 microns). Exine smooth, thin (about 1 micron in thickness), frequently folded, light brownish yellow to almost colourless.

Remarks.—In addition to smooth grains which are in accord with the above diagnosis, some specimens with faintly scabrate exines have been observed. Such specimens have been recorded as *L. cf. reidi,* this course being considered preferable to that of widening the specific diagnosis to include them. Further study of additional material will be necessary to determine whether there is a continuous gradation from smooth to ornamented exines or whether such ornamented grains can be separated as a distinct species.

Laricoidites turbatus (Balme), new combination

Plate 2, Figure 6

Inaperturopollenites turbatus Balme, 1957, C.S.I.R.O. Fuel Research T.C. 25, p. 31, pl. 7, figs. 85, 86; pl. 8, fig. 87.

Diagnosis (Balme 1957, p. 31).—Outline circular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Exine less than 1 micron thick, except in a generally circular polar area about 40 microns in diameter, in which it is differentially thickened and darker in colour. Exine usually heavily folded, particularly around the margins of the thickened area. Finely granulate. Dimensions (40 specimens): Diameter 57-77 microns (mean 67 microns).

Remarks.—Specimens of this species from the Marburg Sandstone agree with this diagnosis, except that the ornamentation would perhaps be better described as scabrate, rather than finely granulate. Regarding the generic affinities of the species, it is clear from the account of Potonié (1958, pp. 76-78) that the principal distinction between *Laricoidites* and *Inaperturopollenites* is one of size, and as this species falls within the size range of the species he has listed under *Laricoidites* (50 to 100 microns), it is here transferred to that genus.

Figured specimen (Plate 2, Figure 6).—Slide No. 392, Stage coordinates 8·5, 104·8; diameter 70 microns. Coordinates of lower right-hand corner of cover glass 2·45, 119·9.

Genus CALLIALASPORITES Sukh Dev

Remarks.—Two species, originally described by Balme (1957, pp. 32, 33) as *Zonalapollenites dampieri* and *Z. segmentatus,* have recently been placed by Sukh Dev (1961) in his new genus *Callialasporites,* as Pflug's name *Zonalapollenites,* lacking a genotype, is inapplicable. Both these species are present, but not abundant, in the samples from the Marburg Sandstone.

Callialasporites dampieri (Balme) Sukh Dev

Plate 3, Figure 5

Diagnosis (Balme 1957, p. 32).—Amb circular. Pollen grain complex, consisting of a circular or rounded triangular central body surrounded equatorially by a narrow bladder. No germinal mechanism visible, although some specimens show vestigial triradiate markings. Exine of central body 1-2 microns thick, finely granulate or indeterminately marked. Bladder 8-15 microns wide, outline indented, very finely granulate, characterized by radially directed folds giving it a frilled appearance. Dimensions (30 specimens): Total diameter 53-78 microns (mean 63 microns), central body diameter 37-53 microns (mean 45 microns).

Figured specimen (Plate 3, Figure 5).—Slide No. 388, Stage coordinates 10·7, 117·0; diameter 67 microns. Coordinates of lower right-hand corner of cover glass 1·7, 120·35.

Callialasporites segmentatus (Balme) Sukh Dev

Plate 3, Figure 6

Diagnosis (Balme 1957, p. 33).—Amb circular, outline indented. Pollen grains complex, consisting of a circular central body surrounded distalo-equatorially by a narrow bladder. No germinal aperture or tetrad markings observed. Exine of central body 2-3 microns thick, dark in colour, rugose or finely granulate. Bladder 6-10 microns wide, crumpled by numerous radial folds giving it a frilled appearance, smooth or faintly granulate. Dimensions (20 specimens): Total diameter 44-60 microns (mean 53 microns), central body diameter 31-48 microns (mean 39 microns).

Figured specimen (Plate 3, Figure 6).—Slide No. 408, Stage coordinates 13·4, 122·2; diameter 53 microns. Coordinates of lower right-hand corner of cover glass 2·0, 124·8.

Genus CLASSOPOLLIS (Pflug) Pocock and Jansonius

Classopollis torosus (Reissinger) Couper

Plate 3, Figures 1, 2 and 3

Remarks.—The specimens from the Marburg Sandstone have a similar range in equatorial diameter (24 to 46 microns) to that given by Couper (1958, p. 157) for *C. torosus.* They also resemble that species in having a narrow girdle (Plate 3, Figure 2) in not always showing a distal pore (Plate 3, Figures 1 and 2), and in the breaking up of the striae on the girdle into "discrete granules arranged linearly" (Plate 3, Figure 3), as described by Couper (1958, p. 157).

Figured specimen (Polar view; Plate 3, Figure 1).—Slide No. 374, Stage coordinates 16·0, 111·35; equatorial diameter 39 microns. Coordinates of lower right-hand corner of cover glass 2·7, 122·1.

Figured specimen (Equatorial view; Plate 3, Figure 2).—Slide No. 426, Stage coordinates 10·0, 111·4; equatorial diameter 34 microns. Coordinates of lower right-hand corner of cover glass 3·8, 125·5.

Figured specimen (Equatorial view; Plate 3, Figure 3).—Slide No. 417, Stage coordinates 14·0, 107·05; equatorial diameter 46 microns. Coordinates of lower right-hand corner of cover glass 2·5, 117·7.

Genus INDUSIISPORITES Leschik

Indusiisporites parvisaccatus (de Jersey), new combination

Plate 3, Figure 7

Pityosporites parvisaccatus de Jersey, 1959, Qld. Govt. Min. J., **60**, 363, pl. 3, fig. 10.

Diagnosis (de Jersey 1959, p. 363).—Pollen grains bilateral, bisaccate. Body of grain broadly elliptical in polar view, length 43 to 80 microns, width 32 to 62 microns (based on 56 measured specimens). Exine of cap smooth to faintly granular, relatively thin (1 to 1·5 microns), no marginal ridge. Sulcus (furrow) psilate to finely granular, without a thickened furrow-rim. Two small air-bladders, sometimes unequal in size, usually shorter than length of grain and with a fine indistinct reticulum. Size range of bladders 33 to 65 microns (length) and 15 to 33 microns (width).

Remarks.—The recent emendation of the genus *Pityosporites* by Manum (1960) necessitates the removal of *P. parvisaccatus* from that genus, as in Manum's diagnosis the bladders are described as "greatly diverging, and narrowing towards their roots"; these features are hardly applicable to the narrow reduced bladders of this species. Accordingly the species is here transferred to *Indusiisporites* Leschik (Leschik 1955, p. 55) which is characterized by an oval corpus with small bladders attached to the distal surface. *I. parvisaccatus* differs from the genotype, *I. velatus* Leschik in being appreciably larger and in having a reticulate bladder ornament. The only other comparable species is *Pteruchipollenites microsaccus* Couper (Couper 1958, p. 151). This species is of similar size and general construction to *I. parvisaccatus,* but Couper's figures suggest that the bladders are even smaller and more rudimentary than in the Queensland specimens.

Figured specimen (Plate 3, Figure 7).—Slide No. 394, Stage coordinates 12·9, 104·4; dimensions 59 x 46 microns. Coordinates of lower right-hand corner of cover glass 3·4, 118·8.

Genus PITYOSPORITES (Seward) Manum

Diagnosis (Manum 1960, pp. 14, 15).—Grains with two bladders. Bladders attached to the distal side of the body and distinctly set off from it, greatly diverging, and narrowing towards their roots; dorsally the roots reach the equator of the body or slightly beyond it, ventrally they are separated by a more or less narrow furrow. Bladders reticulate. Body wall smooth or only finely sculptured, its thickness moderate and not conspicuously increasing towards the roots of the bladders.

Pityosporites spp.

Remarks.—Under this heading are included specimens of bisaccate pollen agreeing with the above definition of *Pityosporites,* but which, because of poor presentation and unfavourable presentation, do not permit specific differentiation.

Genus ALISPORITES (Daugherty) Rouse

Alisporites lowoodensis, new species

Plate 3, Figures 8, 9 and 10

Diagnosis.—Grains disaccate, total span (based on 20 measured specimens) 36 to 70 microns. Corpus longer than broad, sub-circular or broader than long. Length of corpus 27 to 42 microns, breadth 24 to 43 microns. Corpus smooth, pale yellow to colourless, often with slight equatorial thickening. Sacci attached to distal surface of corpus, with slight distal inclination, frequently united around one or both ends of corpus. Sacci approaching a semi-circular outline, length 28 to 45 microns, breadth 17 to 28 microns. Sacci ornamented with a fine, distinct reticulum, brochi 1 to 1·5 microns. Exine of sacci light yellow, about 1 micron in thickness.

Remarks.—This species has been placed in *Alisporites,* rather than in *Pityosporites* because of the opposite emplacement of the sacci, their frequent joining around the ends of the corpus, and the absence of marked narrowing at their roots. It resembles *Pityosporites* in the distal attachment of the sacci, but it is considered that in most features, it is closer to *Alisporites* and accordingly is tentatively assigned to that genus. Its affinities are regarded as probably Coniferous, rather than with the Pteridosperms.

Holotype (Plate 3, Figure 10).—Slide No. 416, Stage coordinates 9·0, 110·15; total span 60 microns. Coordinates of lower right-hand corner of cover glass 2·4, 119·6.

Locality of holotype.—Cuttings from 26 to 29 ft., Proline hole, south bank of Brisbane River at northern end of Portion 203, parish of North, county of Churchill.

Figured specimen (Plate 3, Figure 8).—Slide No. 437, Stage coordinates 6·0, 114·9; total span 55 microns. Coordinates of lower right-hand corner of cover glass 2·4, 122·0.

Figured specimen (Plate 3, Figure 9).—Slide No. 367, Stage coordinates 14·1, 110·0; total span 45 microns. Coordinates of lower right-hand corner of cover glass 3·7, 118·6.

Genus PODOSPORITES Rao

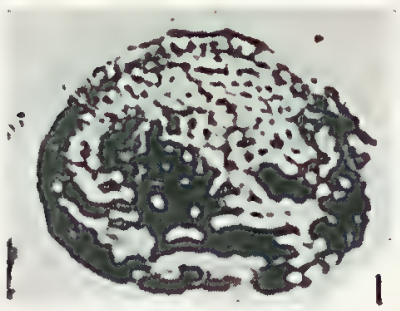
Podosporites sp.

Plate 3, Figures 11 and 12

Description.—Pollen grains trisaccate. Corpus sub-circular in polar view, diameter (based on 13 measured specimens) 44 to 67 microns. Exine thin, about 1·5 microns over cap, finely granulate (1 micron), sulcus (furrow) finely granulate. Sacci broadly attached, ornamented with a fine indistinct reticulum, about 1 micron in thickness. Sacci suboval to semi circular or sub-triangular, length 25 to 42 microns, breadth 11 to 28 microns.

(All photographs approximately 850 diameters)

PLATE 3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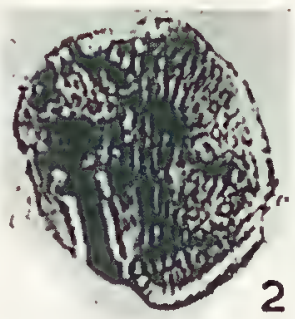
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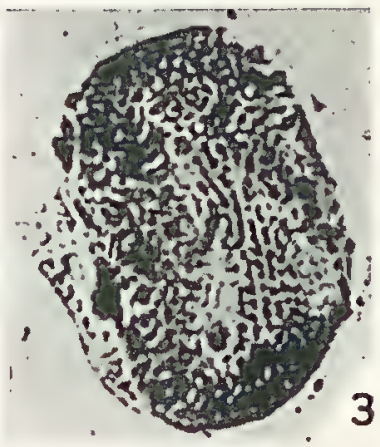
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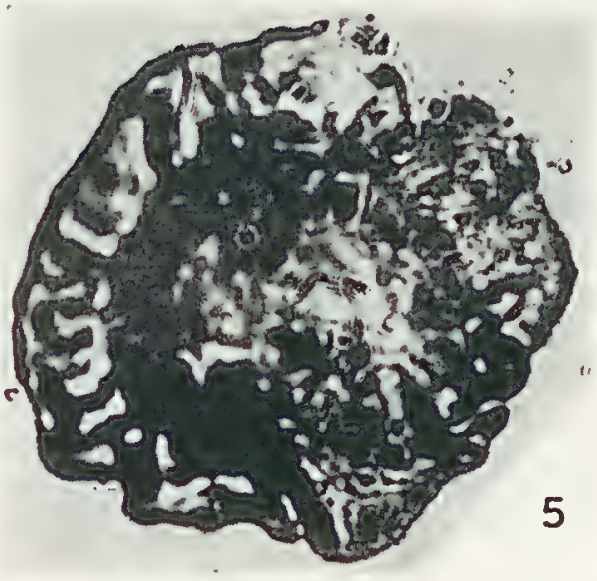
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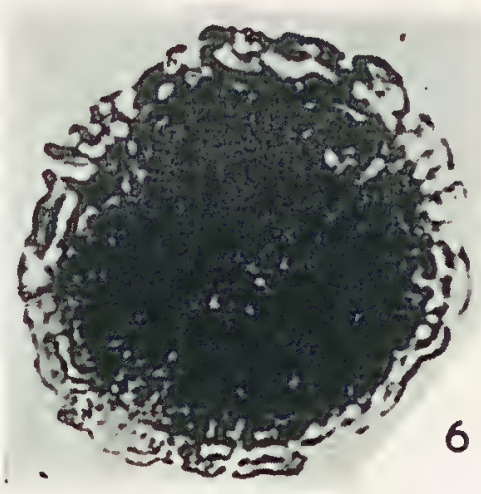
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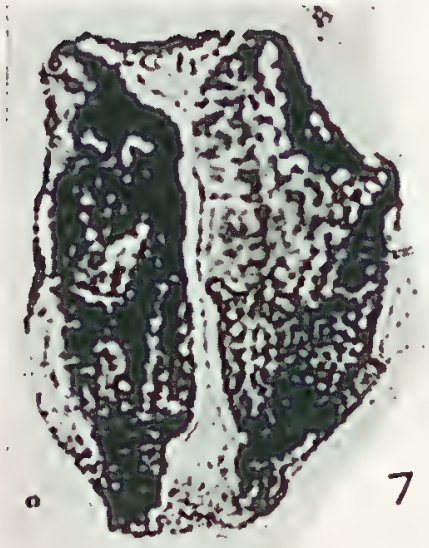
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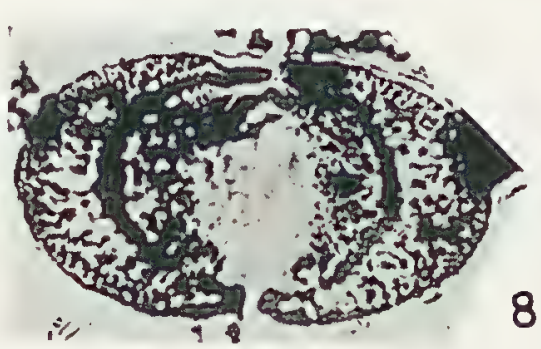
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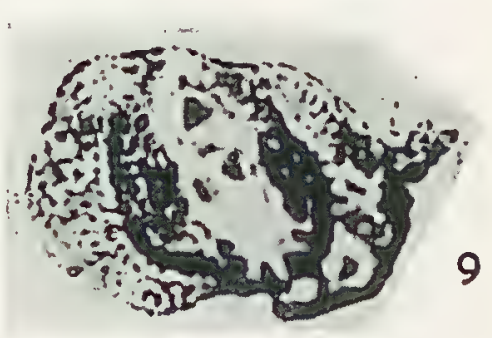
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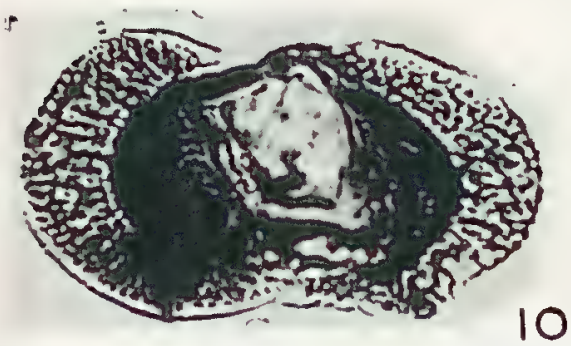
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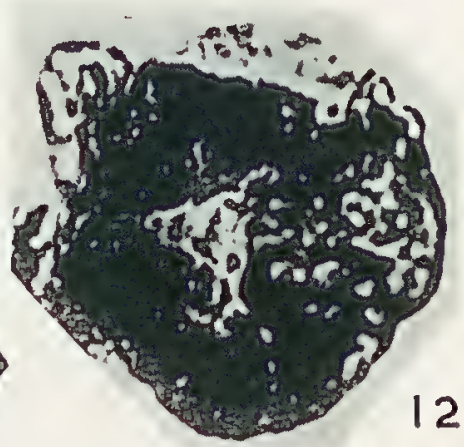
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Figure 1—*Classopollis torosus* (Reissinger) Couper. Polar view.
Figure 2—*Classopollis torosus* (Reissinger) Couper. Equatorial view.
Figure 3—*Classopollis torosus* (Reissinger) Couper. Equatorial view.
Figure 4—*Ginkgocycadophytus magnus* (de Jersey), n. comb.
Figure 5—*Callialasporites dampieri* (Balme) Sukh Dev.
Figure 6—*Callialasporites segmentatus* (Balme) Sukh Dev.
Figure 7—*Indusiisporites parvisaccatus* (de Jersey), n. comb.
Figure 8—*Alisporites lowoodensis*, new species
Figure 9—*Alisporites lowoodensis*, new species
Figure 10—*Alisporites lowoodensis*, new species (Holotype)
Figure 11—*Podosporites sp.*
Figure 12—*Podosporites sp.*

Remarks.—The pollen grains recorded here differ from other Jurassic trisaccate species, such as *Podosporites microsaccatus* (Couper) and *Microcachryidites antarcticus* Cookson, principally in being appreciably larger, in lacking marked ornamentation on the corpus and sacci, and in having a corpus with a rounded outline. A new specific name has not been proposed because insufficient well preserved specimens have been found but the occurrence of trisaccate pollens at this low horizon in the Jurassic is worthy of record.

Figured specimen (Plate 3, Figure 11).—Slide No. 369, Stage coordinates 11·6, 122·0; diameter of corpus 56 microns. Coordinates of lower right-hand corner of cover glass 3·9, 122·9.

Figured specimen (Plate 3, Figure 12).—Slide No. 367, Stage coordinates 15·9, 113·3; diameter of corpus 50 microns. Coordinates of lower right-hand corner of cover glass 3·7, 118·6.

Spores and Pollen Grains (Incertae Sedis)

Genus CIRCULISPORITES de Jersey

Circulisporites parvus de Jersey

Diagnosis (de Jersey 1962, p. 15).—Outline circular or sub-circular (frequently folded). Alete, no definite tetrad markings or germinal mechanism observed. Diameter (based on 87 measured specimens) 15 to 28 microns. Exine smooth on proximal (?) face, distal (?) face ornamented with a series of sub-circular to circular concentric striae, usually 2 to 6 in number, 1 to 3 microns in width (average 1·5 microns) and up to 3 microns apart. Ornament faintly to distinctly marked. Exine colourless to light yellow, less than 1 micron in thickness.

Remarks.—A few rare specimens of this species have been found in some samples from the Marburg Sandstone. It is possible that these specimens may have been re-worked from the older sediments of the Ipswich Coal Measures, in which the species is abundant. This view is supported by their rarity and poor preservation in the samples from the Marburg Sandstone.

6. MICROFLORAL ASSEMBLAGES

(a) Sample from Proline hole, south bank of Brisbane River (near Lowood)

This sample consisted of cuttings from a section of interbedded sandstone and shale, penetrated from 26 to 29 ft. in a hole at the northern end of portion 203, parish of North, county of Churchill. This hole was drilled in an outcrop, which, on the evidence of surface mapping, is at or near the base of the Marburg Sandstone. As any outcrops representing lower horizons are concealed by alluvium, it is not known how much deeper Jurassic sediments extend in this area. This could only be tested by deeper drilling in the Lowood area. Such deeper drilling would thus enable the base of the formation to be defined more precisely and would also provide additional material for investigation of microfloras in this part of the section. The assemblage recorded below is based on a count of 200 specimens from this sample:—

Alisporites lowoodensis	3·5%
? Alisporites sp.	0·5%
Annulispora microannulata	0·5%
Araucariacites sp.	0·5%
Callialasporites cf. segmentatus	0·5%
Classopollis torosus	7·0%
Classopollis sp.	0·5%
Concavisporites mortoni	0·5%
Ginkgocycadophytus nitidus	7·5%
Granulatisporites minor	5·0%
Inapertisporites crassus	12·5%
I. minutus	5·0%
Laricoidites reidi *L. cf. reidi*	2·0%
L. turbatus	0·5%
Leiotriletes directus	21·5%
L. magnus	1·0%
Lycopodiumsporites rosewoodensis	1·0%
Osmundacidites parvus	1·0%
O. wellmanii	1·5%
Perotriletes tenuis	0·5%
Pityosporites spp.	7·0%
Taurocusporites cf. triangularis	0·5%
Indeterminate	20·0%

(b) Coal sample from dump of Glendale tunnel

This abandoned tunnel is located in portion 203, parish of North, county of Churchill, about 1½ miles S.E. of Lowood Post Office. As the workings are abandoned and not safely accessible, the horizon of the seam worked cannot be precisely related to that of the sample from the Proline hole recorded under (a) above. However, from a consideration of the slight dip of the sediments, and of topographic levels, it is evident that the horizon of the seam is probably less than 100 ft. higher in the sequence than that of the former sample. The following assemblage is based on a count of 500 specimens from this coal sample:—

Alisporites lowoodensis	0·2%
Alisporites spp.	0·4%
Annulispora microannulata	0·2%
Araucariacites sp.	1·2%
Classopollis torosus	2·0%
Classopollis sp.	0·4%
Concavisporites mortoni	0·8%
Ginkgocycadophytus nitidus	7·8%
Granulatisporites minor	3·8%
Inapertisporites crassus	1·4%
I. minutus	2·8%
Indusiisporites parvisaccatus	0·6%
Laricoidites reidi *L. cf. reidi*	1·4%
Leiotriletes directus	47·4%
L. magnus	0·4%
Lycopodiumsporites rosewoodensis	3·4%
Perotriletes tenuis	0·2%
Pityosporites spp.	3·0%
Sphagnumsporites adnatus	4·8%
S. tenuis	2·8%
Indeterminate	15·0%

(c) Carbonaceous shale from dump of Glendale tunnel

This sample was closely associated with the coal of sample (b) above. It yielded the following assemblage (based on a count of 500 specimens):—

Alisporites spp.	0·4%
Annulispora folliculosa	0·4%
A. microannulata	0·2%
Araucariacites sp.	5·0%
Classopollis torosus	3·6%
Classopollis sp.	0·6%
Concavisporites mortoni	1·2%
Ginkgocycadophytus magnus	0·4%
G. nitidus	4·2%
Granulatisporites minor	10·6%
Inapertisporites crassus	0·4%
I. minutus	0·6%
Laricoidites reidi / *L. cf. reidi*	1·0%
Leiotriletes directus	50·4%
Leptolepidites verrucatus	0·2%
Lycopodiumsporites rosewoodensis	4·0%
Osmundacidites parvus	0·2%
O. wellmanii	0·4%
Pityosporites spp.	2·4%
Sphagnumsporites adnatus	0·4%
S. tenuis	1·4%
Vitreisporites subtilis	0·4%
Indeterminate	11·6%

(d) Shale from dump of Glendale tunnel

This sample consisted of dark grey shale distinguished from the carbonaceous shale of (c) above by the lack of abundant carbonaceous fragments on the bedding planes. It proved to be relatively rich in spores and pollens, comprising the following assemblage (based on a count of 500 specimens):—

Alisporites lowoodensis	1·0%
Alisporites spp.	0·6%
Araucariacites sp.	0·2%
Callialasporites segmentatus	0·2%
Classopollis torosus	1·6%
Classopollis sp.	0·2%
Concavisporites mortoni	0·6%
Ginkgocycadophytus magnus	0·2%
G. nitidus	3·6%
Granulatisporites minor	5·6%
Inapertisporites crassus	12·5%
I. minutus	5·0%
Indusiisporites parvisaccatus	0·6%
Laricoidites reidi / *L. cf. reidi*	12·6%
Laricoidites turbatus	0·4%
Leiotriletes directus	42·0%
L. magnus	0·8%
Lycopodiumsporites rosewoodensis	7·0%
Osmundacidites parvus	0·2%
O. wellmanii	0·2%
Perotriletes tenuis	5·0%
Pityosporites spp.	5·0%
Sphagnumsporites adnatus	0·4%
S. tenuis	1·6%
Vitreisporites contectus	0·2%
V. subtilis	0·4%
Indeterminate	9·0%

(e) Sample from 876 ft. 9½ in. to 877 ft., Bore N.S. 56 (Rosewood Coalfield)

This sample consisted of carbonaceous shale and siltstone. It was the deepest sample available from this bore, which penetrated about 480 ft. below the top of the Marburg Sandstone. According to Cameron (1962, p. 132) the top of the formation was encountered at 399 ft. 6 in. in this bore, so that this sample came from approximately 477 ft. below this level. An equally precise figure cannot be given for the distance above the base of the formation, but, on the assumption of an approximate thickness of 1,000 ft. for the Marburg Sandstone (J. B. Cameron, verbal communication), the horizon of the sample would thus be about 500 ft. above the base of the sequence. The following assemblage (based on a count of 500 specimens) has been observed:—

Alisporites lowoodensis	0·4%
Alisporites spp.	1·6%
Araucariacites sp.	4·2%
Callialasporites segmentatus	0·4%
Cingulatisporites granulatus	1·0%
Circulisporites parvus	0·2%
Classopollis torosus	1·4%
Concavisporites mortoni	0·4%
Ginkgocycadophytus nitidus	1·2%
Granulatisporites minor	10·2%
Inapertisporites crassus	0·6%
I. minutus	1·2%
Indusiisporites parvisaccatus	1·0%
Laricoidites reidi / *L. cf. reidi*	2·2%
L. turbatus	0·2%
Leiotriletes directus	27·4%
L. magnus	1·2%
Lycopodiumsporites rosewoodensis	2·6%
Lycopodiumsporites sp.	0·4%
Osmundacidites parvus	1·0%
O. wellmanii	1·6%
Perotriletes tenuis	1·4%
Pityosporites spp.	5·4%
Podosporites sp.	0·2%
Sphagnumsporites adnatus	1·4%
S. tenuis	0·6%
Vitreisporites contectus	0·2%
V. subtilis	1·6%
Indeterminate	28·4%

(f) Sample from 853 ft. 3 in. to 853 ft. 5 in., Bore N.S. 56 (Rosewood Coalfield)

This sample consisted of carbonaceous shale and siltstone. On the basis of the evidence quoted in (e) above, its horizon would be about 450 ft. below the top of the Marburg Sandstone. It has yielded the following assemblage (based on a count of 500 specimens):—

Alisporites lowoodensis	0·6%
Alisporites spp.	0·4%
Araucariacites sp.	3·2%
Callialasporites dampieri	0·8%
C. segmentatus	0·4%
Cingulatisporites granulatus	1·4%
Circulisporites parvus	0·2%
Classopollis torosus	3·6%
Classopollis sp.	0·4%
Ginkgocycadophytus nitidus	4·4%
Granulatisporites minor	7·2%
Inapertisporites minutus	2·6%
Indusiisporites parvisaccatus	0·2%
Laricoidites reidi / *L. cf. reidi*	4·4%
L. turbatus	0·4%
Leiotriletes directus	28·6%
L. magnus	1·0%
Lycopodiumsparites rosewoodensis	2·4%
Lycopodiumsporites sp.	0·4%
Osmundacidites parvus	3·0%
O. wellmanii	2·0%
Perotriletes tenuis	0·8%
Pityosporites spp.	2·4%
Podosporites sp.	1·0%
Sphagnumsporites adnatus	0·4%
S. tenuis	1·2%
Vitreisporites subtilis	0·6%
Indeterminate	26·0%

(g) Sample from 840 ft. 3¼ in. to 840 ft. 6¼ in., Bore N.S. 56 (Rosewood Coalfield)

The assemblage from this coal sample has been described previously (de Jersey 1960, p. 6), but has been re-examined in the course of the present investigation. This re-examination has enabled the proportion of indeterminate specimens to be reduced appreciably. It was emphasised previously (de Jersey 1960, p. 6) that this one assemblage could not be regarded as representative of the microflora of the formation; this has been confirmed by study of additional samples which have yielded much more diverse assemblages than those obtained from this thin coal seam. Its horizon is approximately 440 ft. below the top of the Marburg Sandstone.

The sample yielded abundant spores and pollens, comprising the following assemblage (based on a count of 500 specimens):—

Callialasporites segmentatus	0·2%
Ginkgocycadophytus magnus	0·4%
G. nitidus	1·2%
Granulatisporites minor	0·6%
Inapertisporites crassus	0·2%
I. minutus	1·4%
Indusiisporites parvisaccatus	2·0%
Laricoidites reidi / *L. cf. reidi*	42·4%
L. turbatus	1·0%
Leiotriletes directus	35·2%
L. magnus	2·6%
Lycopodiumsporites rosewoodensis	0·2%
Pityosporites spp.	1·0%
Indeterminate	11·6%

(h) Sample from 705 ft., Bore N.S. 56 (Rosewood Coalfield)

The sample examined consisted of calcareous shale and siltstone. Its horizon is about 305 ft. below the top of the Marburg Sandstone. It yielded the following assemblage (based on a count of 500 specimens):—

Alisporites lowoodensis	0·4%
Alisporites spp.	1·6%
Annulispora microannulata	0·2%
Araucariacites sp.	4·0%
Callialasporites dampieri	0·8%
C. segmentatus	0·2%
Classopollis torosus	0·2%
Concavisporites mortoni	0·2%
Ginkgocycadophytus magnus	0·4%
G. nitidus	4·6%
Granulatisporites minor	5·0%
Inapertisporites minutus	0·8%
Indusiisporites parvisaccatus	0·8%
Laricoidites reidi / *L. cf. reidi*	15·6%
Laricoidites turbatus	0·6%
Leiotriletes directus	25·4%
L. magnus	1·8%
Leptolepidites verrucatus	0·2%
Lycopodiumsporites rosewoodensis	3·6%
Lycopodiumsporites sp.	0·2%
Osmundacidites parvus	1·2%
O. wellmanii	1·0%
Pityosporites spp.	3·6%
Sphagnumsporites adnatus	0·2%
S. tenuis	0·4%
Indeterminate	27·0%

(i) Sample from 525 ft., Bore N.S. 56 (Rosewood Coalfield)

This sample, which consisted of calcareous shale and siltstone, was the highest in the sequence examined from the Marburg Sandstone, being 125 ft. below the top of the formation. The following assemblage (based on a count of 500 specimens) is recorded:—

Alisporites spp.	1·2%
Araucariacites sp.	3·2%
Cingulatisporites granulatus	0·2%
Circulisporites parvus	0·2%
Classopollis torosus	1·2%
Ginkgocycadophytus magnus	0·6%
G. nitidus	4·4%
Granulatisporites minor	4·6%
Inapertisporites minutus	0·6%
Ischyosporites marburgensis	1·2%
Laricoidites reidi / *L. cf. reidi*	22·6%
Leiotriletes directus	21·0%
L. magnus	2·0%
Leptolepidites verrucatus?	0·2%
Lycopodiumsporites rosewoodensis	4·4%
Osmundacidites parvus	0·4%
O. wellmanii	1·2%
Pityosporites spp.	4·6%
Sphagnumsporites adnatus	0·2%
Indeterminate	26·0%

7. STRATIGRAPHIC CONCLUSIONS

(a) Comparison with Walloon and Ipswich microfloras

The conformable relationship between the Marburg Sandstone and the overlying Walloon Coal Measures is now well established (Swindon 1960, p. 289). Regarding the relation of the Marburg Sandstone to the older Bundamba Group and Ipswich Coal Measures, Denmead (1955, p. 6) has shown that structural evidence indicates the presence of an unconformity between the Marburg Sandstone and these Triassic sediments. These conclusions are supported by microfloral evidence, as the assemblages from the Marburg Sandstone have much more in common with the microflora of the Walloon Coal Measures than that of the Ipswich Coal Measures.

Thus *Pteruchus*-type pollens (assigned to the genus *Alisporites*), which are so common in the Ipswich coals, and absent from the Walloon microflora, are relatively rare in the Marburg assemblages. *Circulisporites parvus*, which is abundant in the Ipswich, and absent from Walloon assemblages, is very rare in the Marburg microflora, while common Ipswich species such as *Verrucosoporites ipsviciensis, Punctatosporites walkomi* and *Verrucosisporites cameroni* are completely lacking in the Marburg and Walloon assemblages. On the other hand the many species common to the Marburg and Walloon include distinctive species such as *Annulispora folliculosa, Callialasporites dampieri, C. segmentatus, Cingulatisporites granulatus, Ginkgocycadophytus magnus, Indusiisporites parvisaccatus* and *Lycopodiumsporites rosewoodensis.*

The investigation has also indicated features in which the Marburg and Walloon microfloras differ from each other. Species present in the Marburg but absent from Walloon assemblages include:—*Alisporites lowoodensis, Annulispora microannulata, Classo-*

pollis torosus, Ischyosporites marburgensis, Laricoidites turbatus, Lycopodiumsporites sp., Perotriletes tenuis, Podosporites sp. and *Taurocusporites cf. triangularis.* Among the species which occur in the Walloon, but not in the Marburg microfloras are:—*Sphagnumsporites clavus, Gleicheniidites sp., Cyathidites parvus, Verrucosisporites walloonensis, Rugulatisporites ramosus* and *Pityosporites psilatus.* From the aspect of percentage distribution, perhaps the most striking difference is in the proportion of *Laricoidites reidi,* which is the dominant species in the majority of the Walloon assemblages, but is much less abundant in most of the Marburg samples. On the other hand bisaccate pollens tend to be more common in the Marburg than in the Walloon assemblages.

(b) Microfloral evidence on the age of the Marburg Sandstone

On the basis of the microflora of one sample previously studied, and also the conformable relationship to the overlying Walloon Coal Measures, the writer has suggested a late Triassic or early Jurassic age for the Marburg Sandstone (de Jersey 1960, p. 291). The present investigation has provided additional evidence in this regard, as the occurrence of *Classopollis* down to the lowest known outcrop of the formation at Lowood is strong evidence for placing the whole of the Marburg Sandstone in the Jurassic. (This genus is widely distributed in Jurassic and Cretaceous sediments in Australia, but is not known from the Triassic.) The Jurassic age of the formation is further indicated by the presence of forms such as *Ischyosporites, Taurocusporites, Lycopodiumsporites rosewoodensis* and *Laricoidites turbatus,* which are known from Jurassic sediments elsewhere, but have not been found in the Triassic.

This microfloral evidence of a Jurassic age is in conflict with the conclusions of Whitehouse (1955) who suggested an Upper Triassic age for the formation. This suggestion of an Upper Triassic age was based on the occurrence of a jaw fragment of a Labyrinthodont in the Marburg Sandstone at Lowood, described by Longman (1941) as a new species, *Austropelor wadleyi.* Whitehouse considered that the absence of Labyrinthodonts from post-Triassic sediments elsewhere indicated that the Marburg Sandstone could not be younger than Upper Triassic. In the writer's opinion, greater reliance should be placed on the microfloral evidence of a Jurassic age than that of this isolated bone fragment, and the possibility must be considered that the jaw fragment in question, if correctly identified, may be a re-worked fossil from underlying Triassic sediments.

The Marburg microflora provides additional evidence as to its age within the Jurassic sequence. This evidence is based largely on a comparison with Jurassic microfloras from Western Australia, described by Balme (1957). The intercalation of marine and non-marine sediments in certain areas in Western Australia has enabled the microfloral assemblages to be dated accurately, on the basis of marine faunas, and a sequence of Jurassic microfloras is thus available for comparison with the Queensland assemblages. Such a comparison indicates that the Marburg microflora is closest to Balme's "Microflora I," from the Lower Jurassic. Common features are the presence of *Laricoidites turbatus* and *Callialasporites segmentatus,* regarded by Balme as largely confined to the Lower Jurassic, with only a few doubtful specimens found in younger sediments. In addition distinctive species such as *Podosporites microsaccatus, Microcachryidites antarcticus* and *Gleichenia cf. circinidites,* which Balme (1957, Table 3) has recorded from the Bajocian (basal Middle Jurassic) onwards, are absent from the Marburg microflora. On the other hand *Callialasporites dampieri* (known from the Bajocian onwards in Western Australia) is present in the upper part of the Marburg sequence. Consequently general consideration of the evidence from comparison with Balme's succession thus suggests a Liassic age (possibly extending into the Bajocian) for the Marburg Sandstone.

(c) Vertical changes within the Marburg sequence

The assemblages recorded provide a general picture of species distribution through the vertical sequence of the Marburg Sandstone. Detailed study of species distribution has not been possible, as insufficient samples were available to enable the ranges of the species to be charted accurately. This is because only a few shale cores were available from Bore N.S. 56, which penetrated the upper part of the formation, the cores which were available being mainly coarse sandstone, of unfavourable lithology for microfloral studies. In the lower part of the sequence samples are available from only two horizons—those from the dump of the Glendale tunnel and from the Proline hole on the river bank and as these samples are all that are available from a possible thickness of 500 ft. of sediments they are insufficient to give more than a general view of the microflora of this part of the formation. Nevertheless the samples suggest certain trends in species distribution which are recorded here as a guide for future work, if additional material becomes available. These trends are as follows:—

(1) Distribution of *Classopollis.*—This genus reaches its maximum abundance (7·5 per cent.) in the lowest sample; if further samples were available, to assess the effect of variations due to environment (which may account for its absence from the thin coal seam in Bore N.S. 56), it may be possible to demonstrate a trend of decreasing abundance towards the top of the sequence.

(2) Range of *Perotriletes tenuis.*—This species was not found in samples above 853 ft. 3 in. in Bore N.S. 56, and reached a maximum of 5 per cent. in the shale from the Glendale tunnel. It thus appears to be confined approximately to the lower half of the formation and may prove to be a useful marker.

(3) Distribution of *Alisporites lowoodensis.*—While occurring sporadically through most of the sequence, this species is rather more abundant in the lowest sample (3·5 per cent.), and this increased proportion in the basal part of the sequence may find future stratigraphic application.

(4) Range of *Podosporites sp.*—Being found only in the two lowest samples from Bore N.S. 56, this species appears to be restricted to horizons near the middle of the sequence. As it is not a common form, additional material would be necessary to confirm this apparently restricted range.

(5) Distribution of *Cingulatisporites granulatus.*—This species is absent from assemblages from the lower part of the formation, making its first appearance in the sample from 877 ft. in Bore N.S. 56. It thus appears likely to be restricted to the upper part of the sequence. In addition, while rare specimens have been found, higher still, in the Walloon Coal Measures, it is rather more abundant in the two lowest samples from Bore N.S. 56. These samples may thus be from horizons near its acme of of abundance.

(6) *Range of Ischyosporites marburgensis.*—Having been found only in the uppermost sample examined, from about 125 ft. below the top of the Marburg Sandstone, this species may thus prove to be confined to the upper part of the formation.

8. ACKNOWLEDGMENTS

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9. BIBLIOGRAPHY

BALME, B. E., 1957: Spores and pollen grains from the Mesozoic of Western Australia. *C.S.I.R.O. Phys. Chem. Surv. Nat. Coal Res., Tech-Comm.* 25 (December 1957).

BOLKHOVITINA, N. A., 1956: Atlas of spores and pollen from the Jurassic and lower Cretaceous deposits of the Vilyuisk depression. *Acad. Sci. U.S.S.R., Geol. Inst. Proc., Issue* 2, 1-185.

CAMERON, J. B., 1962: Coal resources, Rosewood-Walloon coalfields (United No. 8 mine area). *Qld Govt Min. J.*, **63**, 125-137.

COOKSON, I. C., 1947: Plant microfossils from the lignites of Kerguelen Archipelago. *B.A.N.Z. Antarct. Res. Exped.*, **2**, pt. 8, 129-142.

————, 1953: Difference in microspore composition of some samples from a bore at Comaum, South Australia. *Aust. J. Bot.*, **1** (3), 462-473.

COUPER, R. A. 1953: Upper Mesozoic and Cainozoic spores and pollen grains from New Zealand. *N.Z. Geol. Surv., Palaeont., Bull.* No. 22.

————, 1958: British Mesozoic microspores and pollen grains, A systematic and stratigraphic study. *Palaeontographica B*, **103**, 75-179.

DE JERSEY, N. J., 1959: Jurassic spores and pollen grains from the Rosewood coalfield. *Qld Govt Min. J.*, **60**, 346-366.

————, 1960: Jurassic spores and pollen grains from the Rosewood coalfield. *Geol. Surv. Qld Publ.*, 294.

————, 1961: Spore distribution and correlation in the Rosewood coalfield. *Geol. Surv. Qld Publ.*, 295.

————, 1962: Triassic spores and pollen grains from the Ipswich coalfield. *Geol. Surv. Qld Publ.*, 307.

DENMEAD. A. K., 1955: The West Moreton (Ipswich) coalfield. *Geol. Surv. Qld Publ.*, 279.

LESCHIK, G. 1955: Die Keuperflora von neuewelt bei Basel, II. Iso-und Mikrosporen. *Schweiz. Paldeont. Abh.*, 72

LONGMAN, H. A., 1941: A Queensland fossil amphibian. *Mem. Qld. Mus.*, **12**, 29-32.

MANUM, S., 1960: On the genus *Pityosporites* Seward 1914. With a new description of *Pityosporites antarcticus* Seward. *Nytt. Magasin fur Botanik*, **8**, 1175.

POCOCK, S. A. J., 1961: The microspore genus Cingulatisporites Thomson, 1953. *Journ. Pal.*, **35** (6), 1234-1236.

POCOCK, S. J., and JANSONIUS, J., 1961: The pollen genus Classopollis Pflug, 1953. *Micropaleontology*, **7** (4), 439-449.

POTONIÉ R., 1956: Synospsis der Gattungen der Sporae dispersae, I Teil: Sporites. *Beih. Geol. Jb.*, **23**, 1-103.

————, 1958, Synospsis der Gattungen der sporae dispersae, II Teil: Sporites (Nachträge), Saccites, Alites, Praecolpates, Polyplicates, Monocolpates. *Beih. Geol. Jb.*, **31**, 1-114.

————, 1960: Synospsis der Gattungen der Sporae dispersae, III Teil: Nachträge sporites. Fortsetzung Pollenites mit General Register zu Teil I-III. *Beih. Geol. Jb.*, **39**, 1-189.

ROGALSKA, M, 1954: Spore and pollen analysis of the region of the so-called Blanowice coal in Upper Silesia (Polish with English summary). *Inst. Geol, Bull.* 89 (Warsaw).

STOVER, L. E., 1962: Taurocusporites, a new trilete spore genus from the Lower Cretaceous of Maryland. *Micropaleontology*, **8** (1), 55-59.

SUKH DEV, 1961: The fossil flora of the Jubalpur series-3. Spores and pollen grains. *The Palaeobotanist*, **8**, 43-56.

SWINDON, V. G., 1960: Marburg Sandstone of the type area (in "Geology of Queensland"). *J. Geol. Soc. Aust.*, **7**, 288-291.

WHITEHOUSE, F. W., 1955: The geology of the Queensland portion of the Great Australian Artesian basin. Appendix G in Artesian water supplies in Queensland. *Dep. Coord. Gen. Public Works, Qld Parl. Pap. A*, 56.

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QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 314

COAL RESOURCES, DARLING DOWNS (OAKEY) COALFIELD

Part 1. Balgowan Mine Area
Part 2. Acland Mine Area

By D. C. MENGEL, B.Sc., Geologist

BRISBANE
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1963

COAL RESOURCES, DARLING DOWNS (OAKEY) COALFIELD, BALGOWAN MINE AREA

By D. C. MENGEL, B.Sc., Geologist

SUMMARY

After a lengthy period of operation, known reserves in this area are practically exhausted and abandonment of the mine is near. Development, limited to the south-eastern section of the mine, showed gradual deterioration of the section in this direction.

As part of the programme to establish reserves in the field, four boreholes (including one redrill), totalling 978 ft. 3 in. were drilled ahead of these faces.

Results of drilling showed continued deterioration of the seam and no reserves were proved.

One hole was continued to test the underlying measures. At 386 ft. it entered coarse sandstones similar to those outcropping at Kulpi, 5 miles to the north which could be the equivalent of the Marburg Sandstone that underlies the Walloon Coal Measures in the type area.

Three holes totalling 783 ft. 7 in. were drilled subsequently to investigate a coal seam penetrated in a water bore to the east of Balgowan.

The seam was shown to be unworkable.

INTRODUCTION

The Balgowan Mine Area is located approximately 3 miles north-north-west of the town of Acland and is intersected by the Oakey-Cooyar Branch Railway.

A diamond drilling programme was carried out in the mine area from 13th June to 3rd July, 1958, using the Department of Mines' Sullivan 37 drilling plant. Four boreholes, numbered N.S. 62-65 inclusive and including one redrill (N.S. 64), were completed during that period. The aggregate footage was 978 ft. 3 in.

At the request of the management and with the approval of the Queensland Coal Board, a further three boreholes, numbered N.S. 108, 118 and 119, were drilled during October and November, 1958, in subdivision 52, portion 2389, parish of Watts. The object of this drilling was to investigate a coal seam penetrated by a water bore in this area. Aggregate footage drilled was 783 ft. 7 in.

The following plans and diagrams accompany this report:—

Fig. 1.—A plan of the Balgowan Mine Area showing limits of mine workings, surface contours and boreholes; and a locality plan.

Fig. 2.—A plan of subdivision 52, portion 2389, parish of Watts, showing boreholes and surface contours.

Fig. 3.—Diagrams of mine seam sections and results of analyses.

Fig. 4.—Diagrams of borehole seam sections showing recoveries and results of analyses.

Fig. 5.—Diagrams of generalised bore sections.

MINING

Balgowan Colliery was opened in 1913 by an Ipswich company of which Mr. M. W. Haenke was secretary. The colliery is adjacent to and on the western side of the Oakey-Cooyar Branch Railway.

No. 1 tunnel was in continuous operation until its closure in 1949. Another tunnel, Rosalie tunnel, was opened in 1924 and closed in 1957. In 1949 No. 2 tunnel was developed and is still in use. Pillars are now being extracted and abandonment of the mine is imminent.

Immediately opposite Balgowan Colliery, on the eastern side of the railway, is the old Willeroo Colliery which was opened in 1921 by a company of which Mr. J. Wright was the principal. This colliery worked the same seam as Balgowan Colliery and was abandoned in 1943.

GENERAL GEOLOGY

The coal measures of the area are of Jurassic age and are equivalent to the Walloon Coal Measures. They are not often seen in outcrop owing to their poor resistance to weathering. As a result the country is relatively flat, with hills of Tertiary basalt standing above the general level.

A white medium to coarse porous sandstone outcrops along the Oakey-Cooyar Road a half mile N.N.E. of Kulpi Railway Station and 5 miles north of the mine area. This sandstone consists mainly of quartz grains with a clayey matrix and contains pebble bands.

An outcrop of a similar sandstone occurs 1·7 miles north-east of the Evergreen State School. Much of the country between these two outcrops is covered by basaltic soils but areas of coarse sandy soil suggest that the sandstone is continuous.

These quartz sandstones are lithologically unlike the sandstones of the coal measures which are usually fine grained and argillaceous and without pebble bands.

FIG.1

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

BALGOWAN MINE AREA
DARLING DOWNS COALFIELD

Showing boreholes, mine workings, and topography

To accompany report by D.C.Mengel B.Sc. Geologist
Topographic Survey by E.Cowley

Scale of Chains

5 0 5 10 15 20

Twenty chain grid on True North. Point of origin N.W.cnr. Sub. 66A. Por. 747, Parish of Watts. Elevations in feet on State Datum.

LEGEND

Colliery (Working)	NEATH	Diamond drillhole	◎ N.S.1
Colliery (Abandoned)	NEATH A	Surface Contours	60
Shaft	▫	Seam section measured	⊕2
Fault (Underground)	— — —	Adit	

Elevations taken from mine plans and reduced to State Datum ⊙27'

Limit of Mine Workings:—

Balgowan Working Seam - - - - - -

N.J.H.

60W. 40W. 20W 00

300 N

280 N

260 N.

ROSALIE TNL A

BALGOWAN No.2 TNL

BALGOWAN No.1 TNL A

WILLEROO No.1 A

RAILWAY

OAKEY-COOYAR BRANCH

1951

3N

1390 1400 1410 1420 1430

1381' 1410 1353' 1315' 1306 1292'

⊕1 ⊕2 ⊕3

N.S.62
R.L.Coll. 1435·64
R.L.Surf. 1434·47
R.L.Btm. 1030·64

N.S.65
R.L.Coll. 1453·93
R.L.Surf. 1452·60
R.L.Btm. 1258·01

N.S.64
R.L.Coll 1466·87
R.L.Surf. 1465·54
R.L.Btm. 1276·79

N.S.63
R.L.Coll. 1466·79
R.L.Surf. 1465·54
R.L.Btm. 1279·54

1420 1430 1440 1450 1460 1470 1480

LOCALITY MAP

SCALE OF CHAINS 50 0 50 100

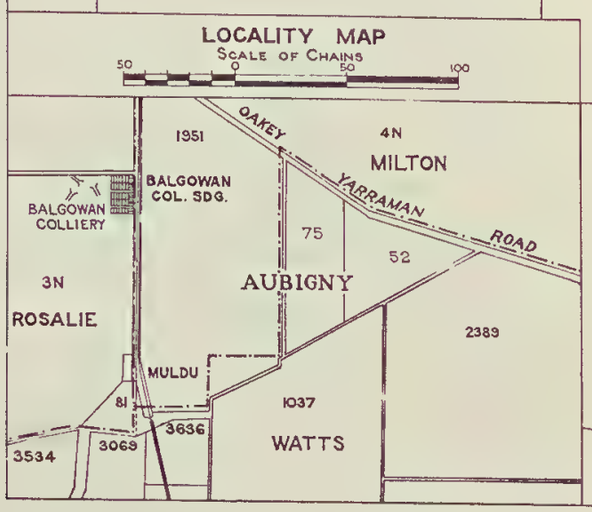
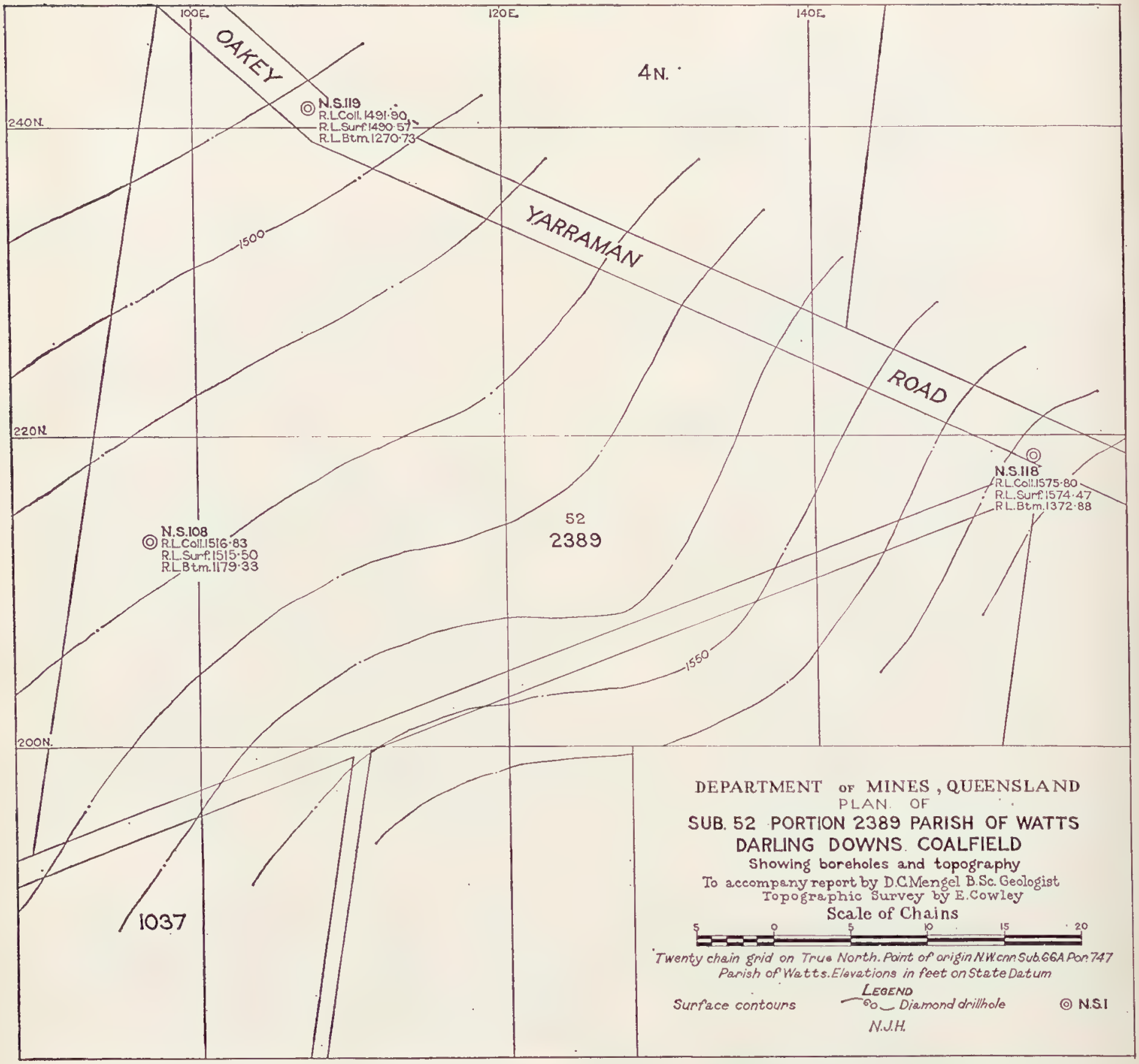


FIG.2



Whitehouse (1955) has equated these sandstones with the Bundamba Group. He states (1953) that sandstones of this group are "coarse and siliceous; they are strongly bedded, and are often very porous." Also he says "The Marburg which separates the Bundamba and Walloon is intermediate in type.——It is a very variable series.——but coarse sandstones of Bundamba type reappear in it." On the evidence available the quartz sandstones north-east of Kulpi could therefore be the equivalent of the Marburg Sandstone which underlies the Walloon Coal Measures in the type area.

The formation to which the sandstones belong is not of major importance to this report. What is important is that the sandstones underlie the coal measures in the area and thus define their northern limits.

SUBSURFACE GEOLOGY

In three of the boreholes, N.S. 63-65 inclusive, approximately 150 ft. of Tertiary basalt was penetrated. This basalt was amygdaloidal, the vesicles being filled with zeolites and a clay mineral. The absence of basalt in N.S. 62 and the variation of

FIG.3

Analysis	Section Sampled	Section 1	Description
Proximate Analysis			
Moisture 5·1%			
Volatile Matter 38·3%			
Fixed Carbon 41·1%			
Ash 15·5%			
Calorific Value			
Joules per gm. 27280			
B.T.U. per lb. 11730	Excluded		
Specific Gravity 1·36			
Coking Tests			
Classification Cw/Cm.			
Swelling index 3			
Ultimate Analysis			
Moisture 5·10 %			
Carbon 64·15 %			
Hydrogen 5·06 %			
Nitrogen 1·00 %			
Sulphur 0·73 %			
Oxygen 8·43 %			
Ash 15·50 %			
		4'2"	1'0" coal ¾" gy – l gy.sh. 1½" coal 2¾" gy sh. with carb. stks. 2'9" coal with 2" inf. coal at top, and 2" inf. coal at 1'3" from b.t.m.

BALGOWAN MINE AREA
DARLING DOWNS COALFIELD
MINE SECTIONS AND DETAILS OF ANALYSES
BALGOWAN WORKING SEAM
To accompany report by D.C. Mengel, B.Sc. (Geologist)
N.J.H.

	Section 2		Section 3	
M% 3·9				
V.M.% 39·9				
F.C.% 42·3				
A% 13·9				
S% 0·65				
Joules/Gm. 27940				
B.T.U./lb. 12020				
S.G. 1·33				
Coking test Class. Aw/Af	Excluded Excluded	4'1¼"	1'1" coal 1" l gy sh. 1½" coal 1½" l. brn. sh. 1" carb. sh. 1½" l. brn. sh. 5½" coal ½" f wn. sh. 2¼" inf. coal 1" f wn. sh. 4½" coal 1½" v. inf. coal 1'2½" coal	4'10"	4½" coal 4" dull coal 6" coal 1¼" l. gy. sh. 2" coal 1½" l. gy. sh. 10" coal 1" gy sh. 1'6" coal ½" gy sh. 2" coal 2½" gy. sh. 4½" coal

FIG.4

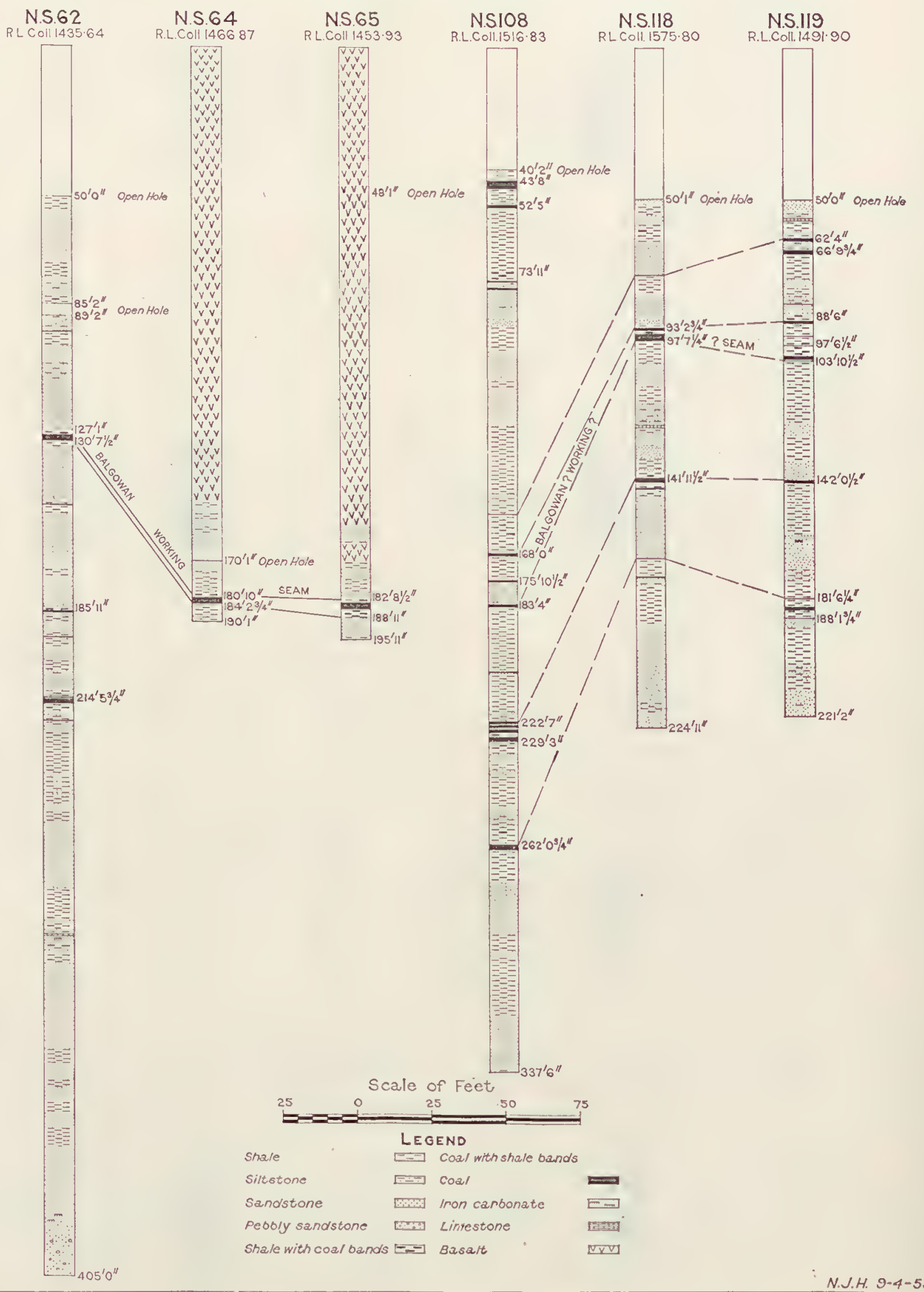
	Section NS65	Description
	179'11½"	
		2'9" l gy f. ss.
	182'8½"	2½" (b.c) inf. coal 3½" (b.c) dk. gy. sh. 1¾" l. gy. sh. 1" (b.c) dk. gy sh 2½" l. gy. sh. 2¼" gy sh. 2½" (b.c) inf. coal 2¾" interbd. l gy sh. & gy. sh. 1" (b.c) l gy – f wn. sh. 3½" coal ¾" inf. coal ¾" dk. gy. sh. 2½" (b.c) coal 10" (p.b.c) coal ½" l. gy. sh. 1¾" coal 3¼" dk. gy. sh. 2¼" coal 1" coaly sh. ¾" dk gy sh.
	187'4¾"	¼" (p.b.c) coal 1" l. gy. sh. ½" inf. coal ¾" coal ¾" coaly sh. 1½" dk. gy sh. 3½" carb. sh. 9" gy sh. 2½" (b.c) coal
Overall Recovery 182'8½"–187'4¾" 89·3%	189'11"	1'0" l. gy. f. ss.

BALGOWAN MINE AREA
DARLING DOWNS COALFIELD
DETAILS OF CORE RECOVERY AND ANALYSES
BALGOWAN WORKING SEAM
To accompany report by D.C. Mengel, B.Sc. (Geologist)
N.J.H.

	Section NS64	Description	Analysis Ash	Recovery per cent	Section Sampled	Section N.S.62	Description
	178'6½"					125'0½"	
		2'3" gy. sh.					2'0" l. gy f. ss.
	180'10"	3½" (b.c) coal 1½" gy sh. ¾" coal ½" coaly sh. ¾" gy sh. ½" dk. sh. 1" soft gy. sh. 3¾" coal ¾" dk. gy. sh. ½" soft f wn. sh. 1'8" (very b.c) coal	A%	24·7	59·4%	127'1"	½" dk. gy sh 1¾" (b.c) coal
						127'9"	½" g.y. sh. 2½" (b.c.) coal
			A%	40·0	100%	128'4½"	1" f wn. sh. 1" (b.c.) coal 2½" f wn. sh. ½" carb. sh. ½" (b.c) coal
						128'11½"	¾" carb. sh. 3" (b.c.) coal
			A%	13·0	100%	129'2½"	4" inf. coal 3" (p.b.c) f wn. sh. 1'5" (p.b.c) coal
	184'2¾"	1'2¾" gy. sh.				130'7½"	9½" shale 2½" inf. coal 1½" coaly sh.
		1" coal					11" shale
Overall Recovery 180'10"–184'2¾" 87·1%	186'6½"	1'0" l. gy. sh.	Overall Recovery 127'1"–130'7½" 91·8%			132'8"	

FIG.5

BALGOWAN MINE AREA
GENERALISED BORE SECTIONS



N.J.H. 9-4-59

reduced levels of its base in the other boreholes indicates considerable relief in the early Tertiary land surface. Also, the occurrence of weathered basalt below fresh unaltered basalt suggests a succession of flows.

The coal measures in this area consist essentially of light-grey shales, siltstones and fine sandstones with several small coal seams. In most boreholes argillaceous sandstones is the dominant lithological type.

Only one coal seam is worked in the mine area. Stratigraphically it lies below the seam worked in the collieries near the town of Acland.

In the Balgowan Colliery, seam thicknesses greater than 4 ft. are exceptional. Three shale bands are recognisable and a typical section of the seam is as follows:—

	1 ft. 0½ in.	**coal**
(A) ———	1 in.	light grey shale
	2 in.	**coal**
(B) ———	2–4 in.	shale (usually light grey at top and brown at bottom)
	7 in.	**coal**
(C) ———	½–2½ in.	light grey shale
	1 ft. 9 in.	**coal**

Band (C) is not always present in the section. In the eastern and south-eastern parts of the mine the coal above band (C) deteriorates and decreases in thickness.

In the boreholes, which are to the east and south-east of the present mine workings, the seam sections confirm this general deterioration. The mine workings have since been extended almost as far east as N.S. 62 in spite of the inferior section shown in that borehole.

N.S. 62 was drilled to a depth of 405 ft. Small unworkable seams were penetrated below the working seam, the deepest at 214 ft. Below this depth lies approximately 190 ft. of barren sandstones and siltstones. From 303 ft. to 386 ft. a fine sandstone with a few shale beds contains small mica flakes but it is otherwise similar lithologically to the sandstones of the Walloon Coal Measures. Below 386 ft. a white quartz sandstone was encountered which is lithologically unlike the sandstone of the coal measures. It consists mainly of medium and coarse quartz grains with a clayey matrix, poorly cemented and porous. In contrast, sandstones of the coal measures are usually fine grained and argillaceous. This quartz sandstone is considered to be identical with the sandstone outcropping near Kulpi.

Small unworkable seams were penetrated in the three boreholes drilled in subdivision 52, portion 2389, parish of Watts.

In N.S. 108 a very banded seam, cored between the depths of 222 ft. 7 in. to 229 ft. 3 in., is the one penetrated in the water bore.

N.S. 118 and 119 were drilled to the north and north-east respectively of N.S. 108 to investigate the possibility that the seam improved to the rise, as the worked seam does in Balgowan Colliery. This improvement does not occur.

Seam correlation in subdivision 52 is not certain but a likely correlation has been suggested in Figure 5.

STRUCTURAL GEOLOGY

The regional dip of the coal measures in the area is very gentle (less than 5 degrees) and is in a southerly direction. Local irregularities occur in both grade and direction of the dip.

No major faults were encountered in mining operations and, generally, faulting has not hindered development to any extent.

NATURE OF COAL

The coal from the worked seam is of high volatile A bituminous rank. Fixed carbon, on a dry, mineral-matter-free basis, ranges from 52·3 per cent. to 53·2 per cent. Calorific value calculated on a moist, mineral-matter-free basis ranges from 14,070 to 14,200 lb. B.T.U.'s per lb. Coking properties are negligible.

CONCLUSION

The sandstones, which outcrop N.N.E. of Kulpi on the Oakey–Cooyar Road and which were encountered in N.S. 62, define the northern boundary of the coal measures.

Drilling failed to locate a workable coal seam in the area east of Balgowan where coal bearing strata had been penetrated in a water bore.

No reserves of coal were proved by the drilling carried out in the Balgowan Mine Area, deterioration of the seam shown by working faces being confirmed. The underlying measures were tested with negative results.

REFERENCES

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272,* 1-20.

WHITEHOUSE, F. W., 1953: The Mesozoic environment of Queensland. *Rep. Aust. N.Z. Assoc. Adv. Sci., 29,* 83-106.

———, 1955: The geology of the Queensland portion of the Great Artesian Basin. Appendix G in Artesian water supplies in Queensland. Dep. Co-ord. Gen. Public Works, *Parl. Pap. A, 56-1955, Brisbane.*

3rd July, 1959.

COAL RESOURCES, DARLING DOWNS (OAKEY) COALFIELD, ACLAND MINE AREA

By D. C. MENGEL, B.Sc., Geologist

SUMMARY

Diamond drilling to prove reserves in the Acland working seam was carried out during 1957 and 1958. Leases held by the company were tested on a grid system with approx. 10 ch. interval. Seventy-eight boreholes totalling 10,125 ft. 6 in. were drilled.

The seam worked in Acland Colliery is the bottom 8 ft. of a section of coal and shale bands 40 ft. to 60 ft. in thickness. Although the measures are in general lenticular, drilling showed the working section to be essentially similar throughout the area tested. Two major faults trending N.W.-S.E. and N.E.-S.W. were disclosed.

Measured reserves, proved over an area of 562 acres with average seam thickness of 5 ft. 7¼ in. amount to 5,250,000 tons.

Indicated reserves exist in an area of 50.8 acres in the north-western part of the mine area. With average workable thickness of 5 ft. 0¼ in. they have been estimated at 400,000 tons.

INTRODUCTION

The Acland Colliery is located in the township of Acland on the eastern side of the Oakey-Cooyar Branch Railway. Areas held under lease by the Acland Coal Company Pty. Ltd. comprise subsections 64 and 65 of portion 747 (Coal Mining Lease 87); subsections 66 and 67 of portion 747 (C.M.L. 109); and most of portions 3625 and 3626, parish of Watts (C.M.L. 123). Also considered in this report are subsections 61, 62, 62A and 63 of portion 798, parish of Watts held under C.M.L. 97 by the owners of Balgowan Colliery.

A shallow diamond drilling programme to prove reserves in the Acland Colliery working seam was carried out in the above leases using the Department of Mines' Longyear No. 2 drill from 18th March to 17th May, 1957, and the Sullivan 37 drill from 12th September, 1957, to 2nd December, 1958.

Owing to the lenticular nature of the coal measures boreholes were sited, where possible, at the intersections of a 10 ch. grid system. This plan could not be strictly adhered to due to owners' use of land for agriculture and general farming.

Seventy-eight boreholes, including two redrills, were drilled in the area ranging in depth from 62 ft. (N.S. 37) to 401 ft. 2 in. (N.S. 17). Aggregate footage was 10,125 ft. 6 in.

This report is accompanied by a table showing the recovery percentages and results of analyses of borehole seam sections, and the following plans and diagrams:—

Figure 1—A plan of the Acland Mine Area showing surface geology, boreholes, mine workings, topography, and area of measured reserves; and a locality plan.

Figure 2—Diagram of generalised bore section.

Figure 3—Diagrams of mine seam sections and results of analyses.

Figures 4–12—Diagrams of borehole seam sections.

COAL MINING DEVELOPMENT

Coal mining near the town of Acland began in 1913.

The Swensen Bros., who were associated with mining in the Kingsthorpe district, worked coal from a shaft in portion 3642, parish of Watts, during that year. The shaft was abandoned because it was unsuitably situated for railway siding purposes.

Colonel King, the owner of Gowrie Colliery near Kingsthorpe, also sank a shaft in the same portion during 1913. The colliery that was subsequently developed was the first Acland Colliery. Coal was worked from two tunnels—one in portion 3642 and the other in portion 3975, parish of Watts. The colliery was abandoned in 1929.

In 1914 the Kingsthorpe Coal Company acquired portion 3525, parish of Watts. A tunnel (Kingsthorpe Acland Colliery) was driven to the seam but operations were not successful owing to the large amount of water encountered and the poor quality of the coal.

The present Acland Colliery was opened in 1929 and has since been in continuous operation.

GENERAL GEOLOGY

The coal measures of this coalfield are equivalent to the Walloon Coal Measures of Jurassic age. The formation is not often seen in outcrop owing to its low resistance to weathering and gives rise to country of relatively flat relief. In places the coal bearing strata are unconformably overlain by Tertiary basalt.

FIG.1

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

ACLAND MINE AREA
DARLING DOWNS COALFIELD

Showing surface geology, boreholes, mine workings, topography, & boundaries of measured reserves

To accompany report by D.C.Mengel B.Sc. Geologist

Topographic Survey by E.Cowley

Scale of Chains

5 0 5 10 15 20

Twenty chain grid on True North. Point of origin N.W.cnr. Sub 66A Por 747, Parish of Watts. Elevations in feet on State Datum.

LEGEND

- Geological boundary — position approx.
- Probable or indefinite boundary
- Underground fault — position accurate
- " " " approx.
- " " " indefinite
- Strike and dip of fault
- Surface contours
- Colliery (working)
- " (abandoned)
- Seam section measured
- Adit
- Shaft
- Diamond drillhole
- Percussion "
- Section line
- Limit of mine workings :— Acland Working Seam
- Boundaries of measured reserves :— Acland Working Seam
- " " indicated " :— Acland Working Seam

N.J. Hunt del.

LOCALITY MAP

Parish of Watts
County of Aubigny
Scale of Chains

50 0 50 100 150

CROSS SECTION

A — A'

N.S.97 N.S.88 N.S.96 N.S.132 N.S.133,134 N.S.99 N.S.9 N.S.6 N.S.11 N.S.27

Acland Working Seam

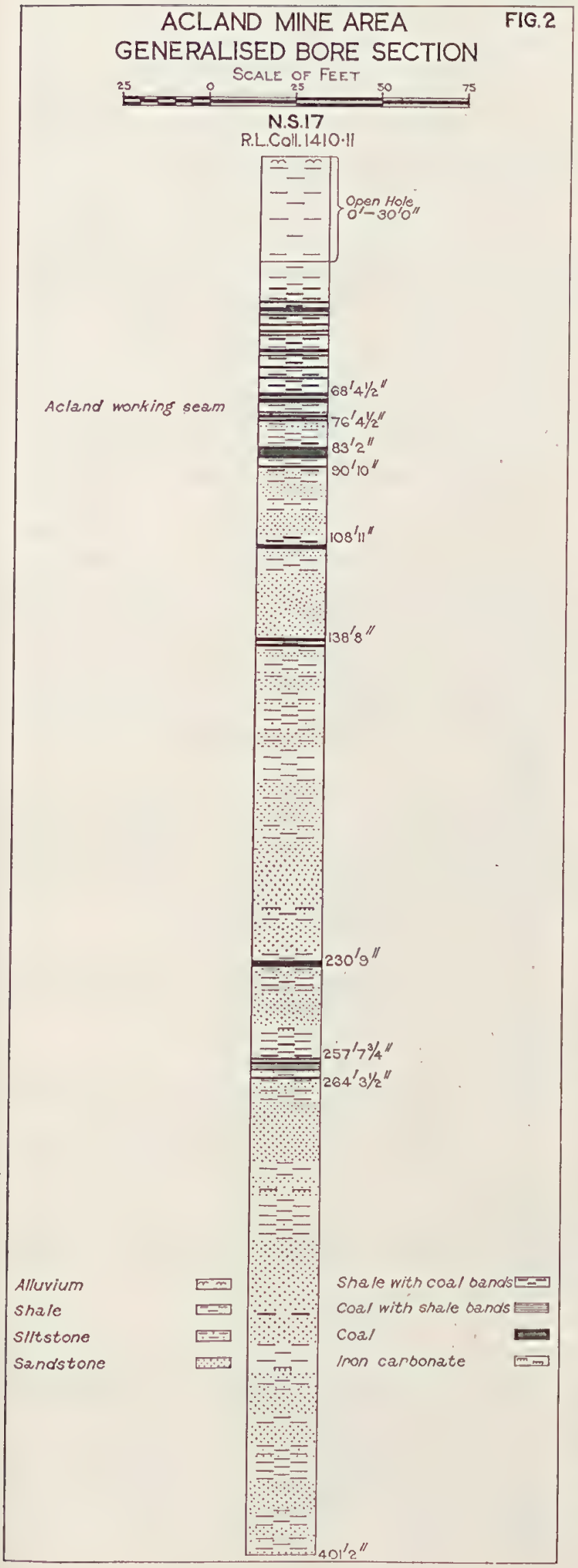
1000' above state datum

LEGEND

Alluvium, Sandstone, Shale, Siltstone, Iron carbonate

Thin limestone beds, Coal, Coal with sh. bands, Sh. with coal bands, Basalt

N.J.H.



SUBSURFACE GEOLOGY

Basalt

Tertiary basalt was penetrated in six of the boreholes (N.S. 26, 27, 28, 33, 42, and 44) in the north-eastern part of the mine area.

The presence of weathered basalt below fresh unaltered basalt suggests a succession of flows. An interesting occurrence of approximately 1 ft. 6 in. of "billy" between two basalt flows was noted in N.S. 27. The "billy" was encountered at a depth of 95 ft. 9 in. and was overlain by 3 ft. of decomposed sandstone.

The unaltered basalts usually are black in colour and minutely crystalline. Some are porphyritic containing phenocrysts of olivine. Vesicular and amygdaloidal basalts are also common, the vesicles in the latter being partly or wholly filled with zeolites, calcite, and clay minerals. The basalts are often decomposed to a red clay (N.S. 27) and magnesite veins are common.

Coal Measures

Lithologically the coal measures consist of light grey shales, siltstones, and fine grained sandstones with several coal seams. Thin beds of limestone, which often show cone-in-cone structure, and ironstone are also present. Lenticularity of beds is a feature of the formation.

The full thickness of the coal measures is not known. The upper beds have been eroded to an unknown extent and no borehole penetrated to the underlying non-productive beds which crop out 8 miles to the north of the mine area. Four hundred feet of the measures were tested by N.S. 17.

Fossils are not abundant in the bore cores. Portions of fronds of *Dicroidium* sp. and *Cladophlebis* sp. and nodal diaphragms of *Equisitites* sp. have been identified.

Coal Seams

The coal seam worked in the present Acland Colliery is the bottom 8 ft. of a sequence of coal and shale bands which ranges from 40 ft. to 60 ft. in thickness. This sequence, in the extreme southern part of the area, is split some 20 ft. from the floor by a stone band which ranges in thickness from 4 ft. (N.S. 80) to 24 ft. (N.S. 90, 98). This band consists of shale and/or fine sandstone. In the old Acland Colliery (at Beith siding) a section of coal immediately above this band was also mined but, in the area tested by the boreholes, it is strongly banded.

In the present Acland Colliery the seam is worked from a cross measure drift under approximately 95 ft. of cover. The seam averages 7 ft. 6 in. in thickness and includes several shale bands of which two are persistent dividing the seam into three sections. These sections and the persistent bands are described as follows:—

(i) The **"top coal"** ranges in thickness from 1 ft. to 2 ft. 6 in. It contains small shale bands which are not persistent and, in places, the deterioration of this coal section is due to the abundance of these bands. Further, the quality of the "top coal" in itself is variable.

(ii) The **"top band"** is composed of waxy light coloured shale and ranges from 1 in. to 6 in. in thickness.

(iii) The **"middle coal"** ranges up to 2 ft. in thickness and averages 1 ft. 7 in. Again the quality of the coal is not uniform. Two thin bands of shale, separated by a few inches of coal and lying 4 to 6 ins. from the base of this section, are recognisable in places but do not persist throughout the colliery as in other collieries on the field. In the east-north-eastern parts of the mine workings this "middle coal" deteriorates considerably due to increasing thickness and number of shale bands and here, including the top band, thicknesses of 3 ft. have been measured.

(iv) The **"double band"** consists of two bands of light coloured shale separated by 2 to 4 in. of coal.

(v) The **"bottom coal"** ranges in thickness from 2 ft. 6 in. to 4 ft. This section is relatively uniform in quality and usually is free from shale bands. In the south-eastern parts of the workings, where the "bottom coal" is only 2 ft. 6 in. thick, some of the coal near the top deteriorates to inferior coal as the fault bounding the workings is approached.

At the base of the "bottom coal" is a thin persistent shale band **("bottom band")** which is used as the floor in the workings. Below this band is a small band of coal (approximately 3 in.) which has been worked in places.

Seam sections in the boreholes are essentially similar to those in the colliery. However, in C.M.L. 123 to the west of the railway, an increase in size of some shale bands (e.g. N.S. 17) makes correlation more difficult. This increase in shale band thickness combined with the poorer quality coal in the workable sections may restrict development in this part of the mine area.

The "top coal" in the boreholes is variable in both quality and thickness of coal and in number and thickness of shale bands. The "middle coal" is similar to that section in the colliery. The "bottom coal" is again relatively uniform and thicknesses fall into the same range as in the mine workings. In many of the boreholes (particularly in C.M.L. 109) a band of grey or carbonaceous shale, ranging in thickness from a few inches to 11 in. (N.S. 131), appears approximately 1 ft. 9 in. from the base of this section.

The coal measures were tested to a depth of 400 ft. in N.S. 17. Below the working seam five coaly horizons were encountered (see figure 2). These sections were either too strongly banded or not of sufficient thickness to warrant further investigation at present.

STRUCTURAL GEOLOGY

The regional dip of the coal measures is very gentle (2–3 degrees) in a south-south-easterly direction. Local irregularities occur in both grade and direction of dip.

Faulting in the mine workings follows two general directions—N.E.–S.W. and N.W.–S.E. One of the two major faults disclosed by drilling operations, a N.E.–S.W. reverse fault, has been encountered in the south-eastern parts of the mine. It was penetrated by a south-easterly heading where there is only minor displacement of the seam. The throw, however, increases to the north-east and a study of reduced levels on the floor of the seam in the boreholes indicates an upthrow increasing to at least 100 ft. to the north-west. A similar study of the boreholes to the south of the fault indicates a marked tilting of the seam to the north as the fault is approached (see cross-section).

The other known major fault causes a further displacement of the seam in N.S. 40. This fault probably follows the N.W.–S.E. direction and has a downthrow of 80–100 ft. to the north-east. Whether this is a normal or reverse fault is unknown.

Minor faulting has been encountered in other boreholes and in the mine workings. It is probable that all faults in the area follow either of the two general directions as shown by faults in the mine workings.

NATURE OF COAL

The better quality coal is usually bright while the inferior coal is dull and grades to carbonaceous shale.

The coal is distinctive with a high percentage of volatiles and a high cuticle and spore exine content. It is classified as high volatile A to B bituminous rank (A.S.T.M. classification). Fixed carbon calculated on a dry, mineral-matter-free basis ranges from 44·96 to 54·84 per cent. and calorific values calculated on a moist, mineral-matter-free basis range from 13,600 to 15,460 B.T.U.'s per lb. Coking properties are weak to negligible.

Coal from a shaft in this area has been tested for oil yield on destructive distillation and yields of more than 40 gallons per ton have been obtained. It has been suggested that the high tar yield of some of the coals could form the basis of a chemical industry. The coal is also considered ideal for gas making.

COAL RESERVES

Coal reserves in this coalfield have been calculated in two categories—measured and indicated.

Measured Reserves

To be included in this category the following arbitrary conditions have been established:—

1. A maximum distance of 12½ chains between points of observation, i.e. borehole, perimeter of mine workings, &c.

2. A limit of 5 chains beyond a peripheral point of observation has been placed on the extent of workable coal.

3. The coal section must have—
   (*a*) A thickness of at least 3 ft.
   (*b*) An ash content, after the exclusion of bands normally removed in mining, of not more than 25 per cent.
   (*c*) A depth below the surface of at least 50 ft.

The unavailability of coal due to faulting has been disregarded and no allowance has been made for loss of coal in mining.

In the Acland Mine Area measured reserves in the Acland working seam exist over an area of 562 acres. The average thickness of workable coal is 5 ft. 7¼ in. with a weighted average specific gravity of 1·374. Reserves have been estimated at 5,250,000 tons.

Indicated reserves

In this category all the above conditions apply except that the distance between points of observation is greater than 12½ chains.

Indicated reserves exist over 50·8 acres in the north-western part of the mine area. The average thickness of workable coal is 5 ft. 0¼ in. with a weighted specific gravity of 1·372. Reserves have been estimated at 400,000 tons.

CONCLUSION

Measured coal reserves of 5,250,000 tons have been proved in the Acland working seam over an area of 562 acres. The average thickness of workable coal is 5 ft. 7¼ in.

A further 400,000 tons of indicated reserves exist over an area of 50·8 acres in the north-western parts of the mine area. The average workable thickness is 5 ft. 0¼ in.

The limits of reserves in the Acland working seam have not been reached along the eastern margin of subsection 68 portion 747, parish of Watts. Drilling to the east of this area is justified.

REFERENCES

BALL, L. C., 1946: Oil shale and coal, Acland. *Qld Govt Min. J., 47,* 311-312.

HAWTHORNE, W. L., 1960: Coal resources Darling Downs, Sugarloaf mine area, Oakey. *Qld Govt Min. J., 61,* 358-362.

MENGEL, D. C., 1963: Coal resources, Darling Downs (Oakey) coalfield, Balgowan mine area. *Geol. Surv. Qld Publ. 314,* 1-5.

REID, J. H., 1922: Geology of the Walloon-Rosewood coalfield. *Geol. Surv. Qld Publ., 272,* 1-20.

27th April, 1960.

FIG.3

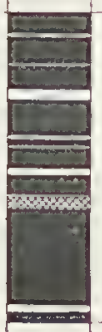
ACLAND MINE AREA

Mine Sections & Details of Analyses

Acland Working Seam

To accompany report by D.C.Mengel B.Sc.(Geologist)
N.J.H.

Section A



Roof:– shale

6"coal 1"wh.sh.
8"coal ½"gy.sh.
6½"coal 3¼"brn.sh.

10"coal
1¼"brn.sh 2"coal ½"brn.sh
5¾"coal
2¼"brn.sh. 5¾"coal
½"gy.sh. 3¾"inf.coal

2'3½"coal with penny bands at 10½" & 1'3½"

2"brn.sh. 2½"coal

Section B

2'4"coal

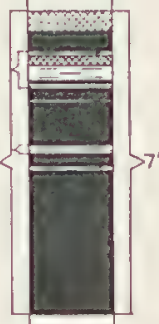
1¼"brn.sh.
7½"coal with penny band at 6½"
1"brn.sh. 3"coal 1¼"inf.coal
½"coal ¼"gy.sh. 8"splinty coal
1¼"–¼"gy.sh.1"coal 1¼"gy.sh.
7½"coal ¼"–2"gy.sh.
3½"coal
1"gy.sh.
1'3"coal

Prox.Analysis S.,Cal.Val.,& S.G.

M.%	5·0
V.M.%	38·4
F.C.%	39·7
A%	16·9
S.%	0·60
B.T.U./lb.	11457
S.G.	1·354
Coking Class.	Cw

Section Sampled 459/59

Section C



Roof:– gy.sh.

1½"inf.coal & coal
1"dk.gy.sh 3"inf.coal
1½"dk gy.sh. 3"fwn.sh. 1"coal
1"carb.sh. 3½"coal ½"dk.gy.sh.
1'0½"coal
1½"fwn.sh. 1"carb.sh.
3½"coal 1"fwn.sh.

3'5"coal

Floor:– carb.sh.

Section D

1'0"coal
1"dk.gy.sh. 3½"inf.coal 2"fwn. sh. 1"gy–dk gy.sh.1"coal 1"dk. gy.sh.3½"coal ¾"l.&dk.gy.sh. 6"coal 1¾"carb.sh. 5"coal
2"l.gy.sh. 4½"coal
½"–1½"l.gy.sh.

3'5"coal

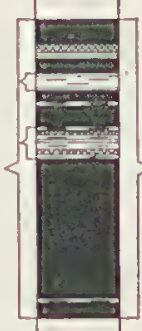
Floor:– carb.sh.

Prox.Analysis S.,Cal.Val.,& S.G.

M.%	5·0
V.M.%	37·5
F.C.%	37·1
A.%	20·4
S.%	0·57
B.T.U./lb.	10920
S.G.	1·368
Coking Class.	Af/Cw

Section Sampled 460/59

Section E



7"coal
4"inf.coal→carb.sh. ½"fwn. sh. 4"coal 1"carb.sh.→inf.coal
3"fwn.sh. 1"inf.coal 3"coal
1"gy.sh. 3"coal 3"slightly inf. coal 1"fwn.sh. 1½"inf.coal.
1"brn.sh.1"inf.coal 2"fwn.sh.
1½"inf.coal 1"fwn.sh.

3'4"coal

1"gy.sh. 4"coal

FIG. 4

ACLAND MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

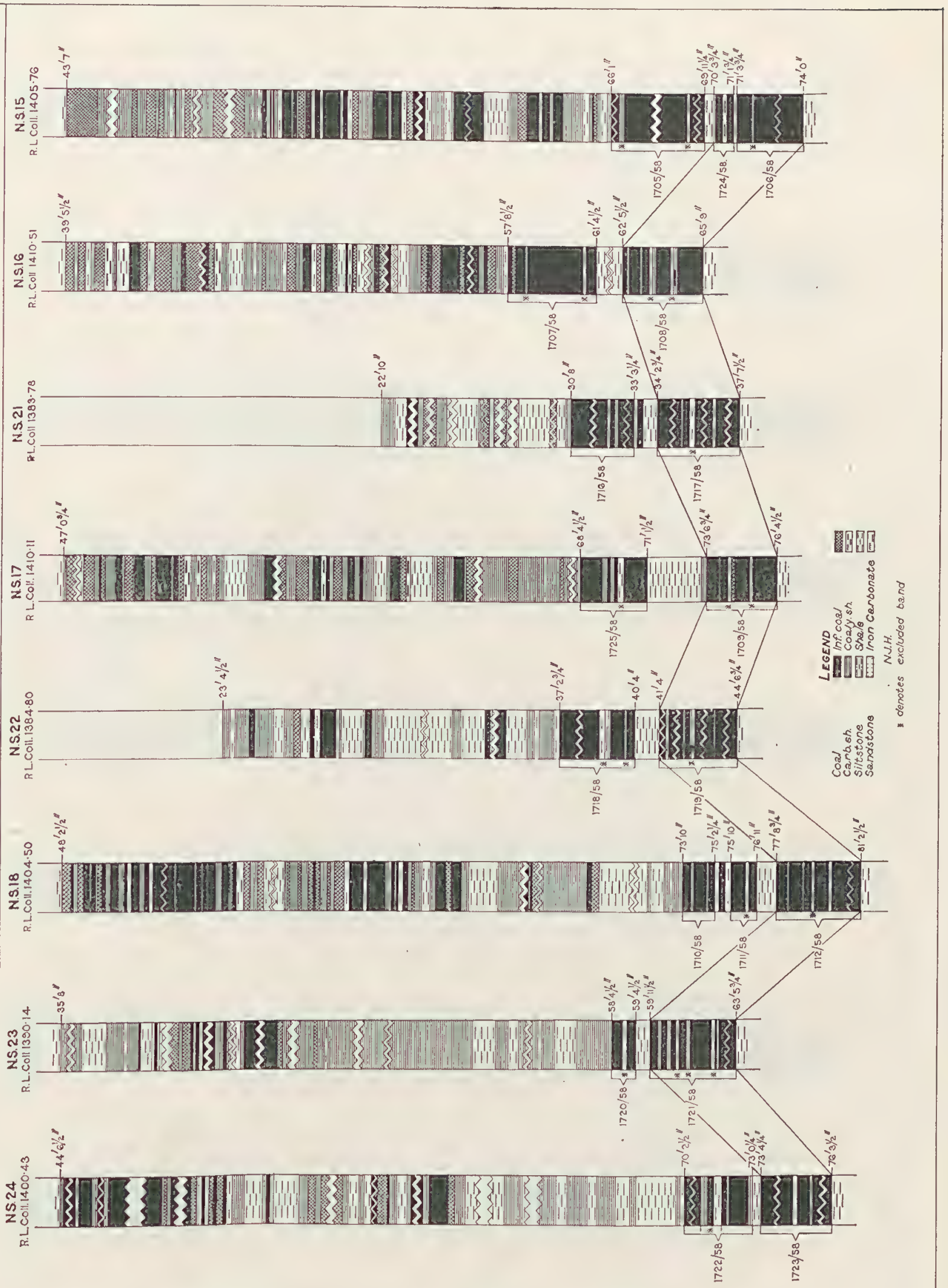
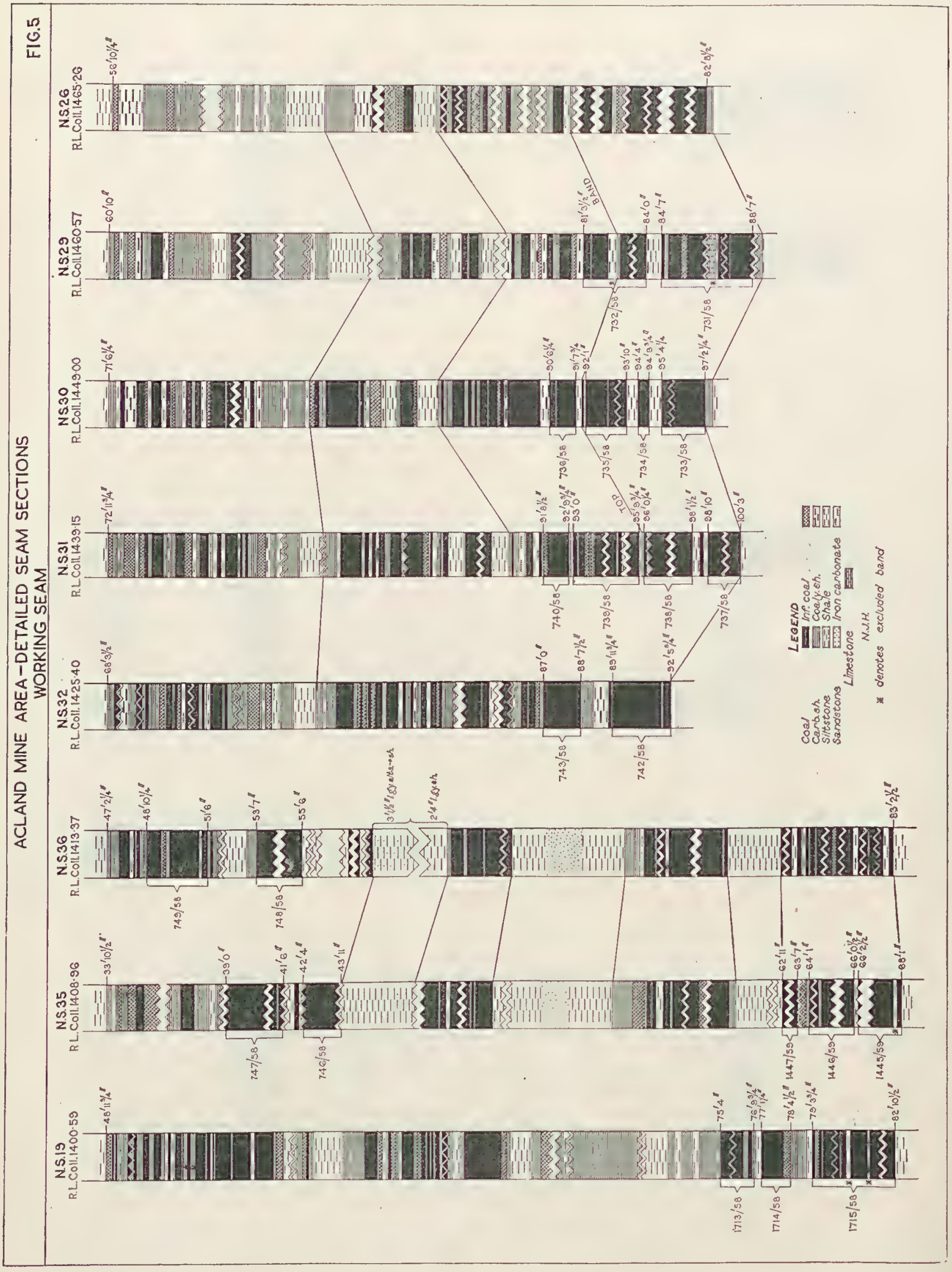


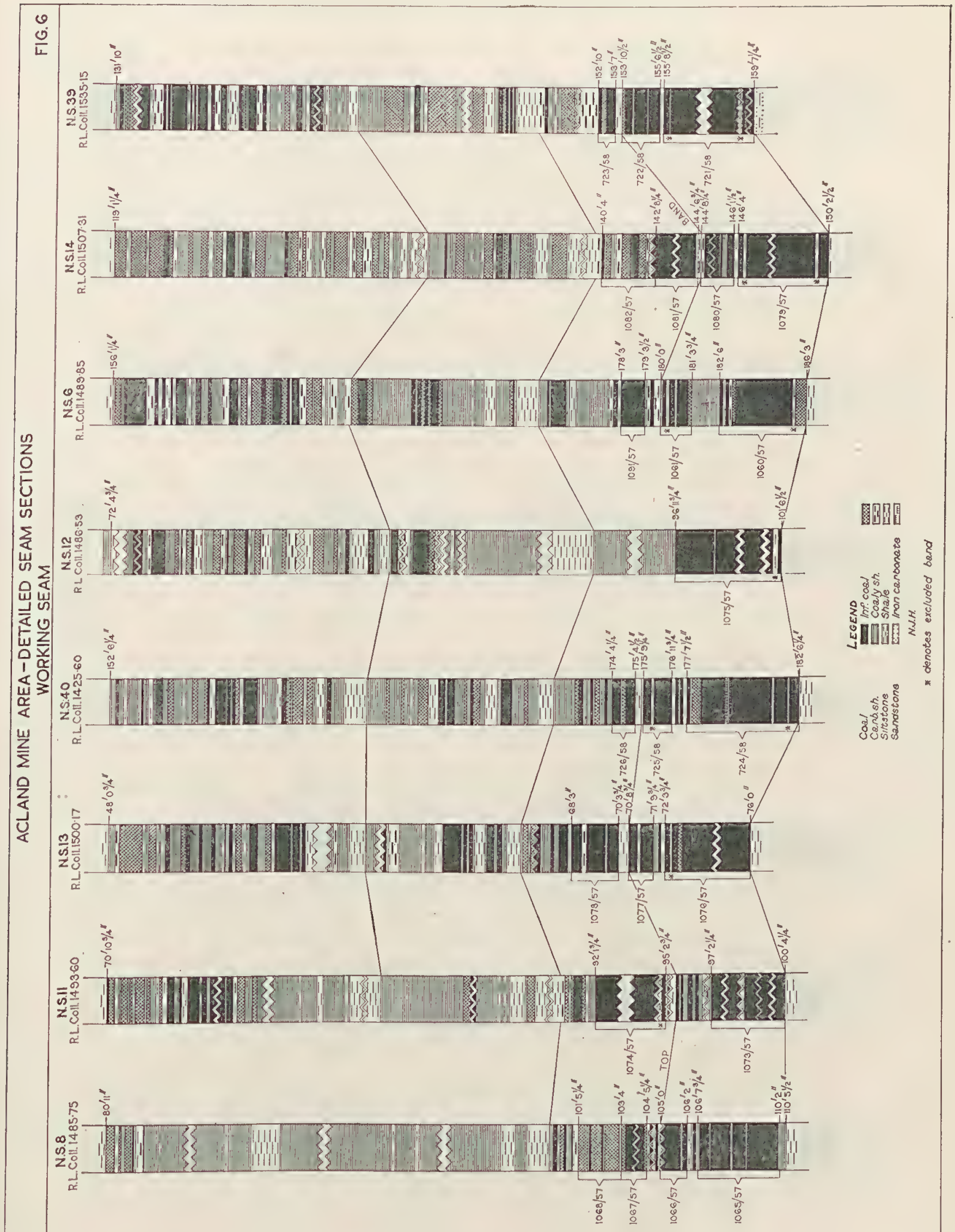
FIG.5

ACLAND MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM



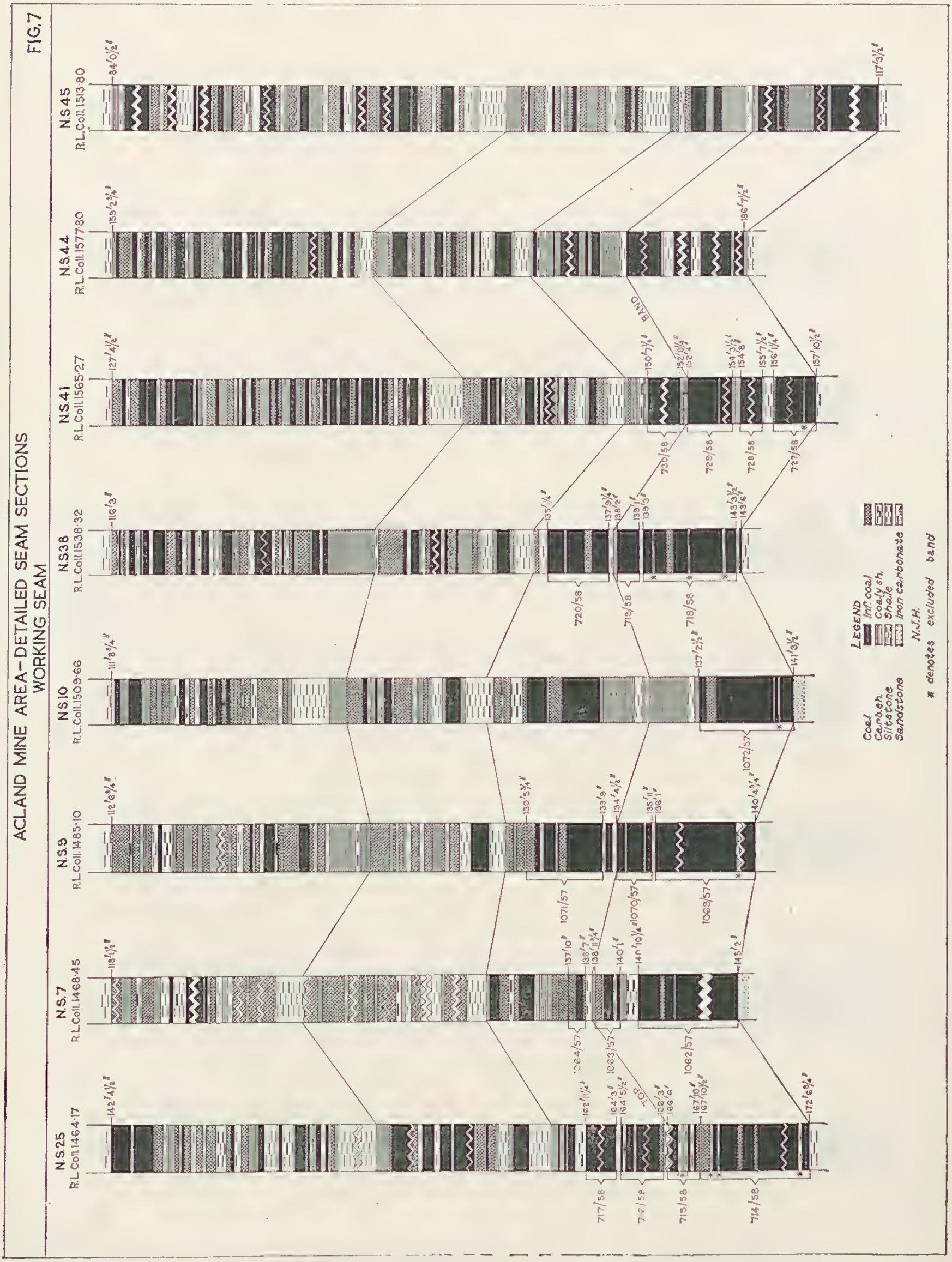
ACLAND MINE AREA – DETAILED SEAM SECTIONS
WORKING SEAM

FIG. 6



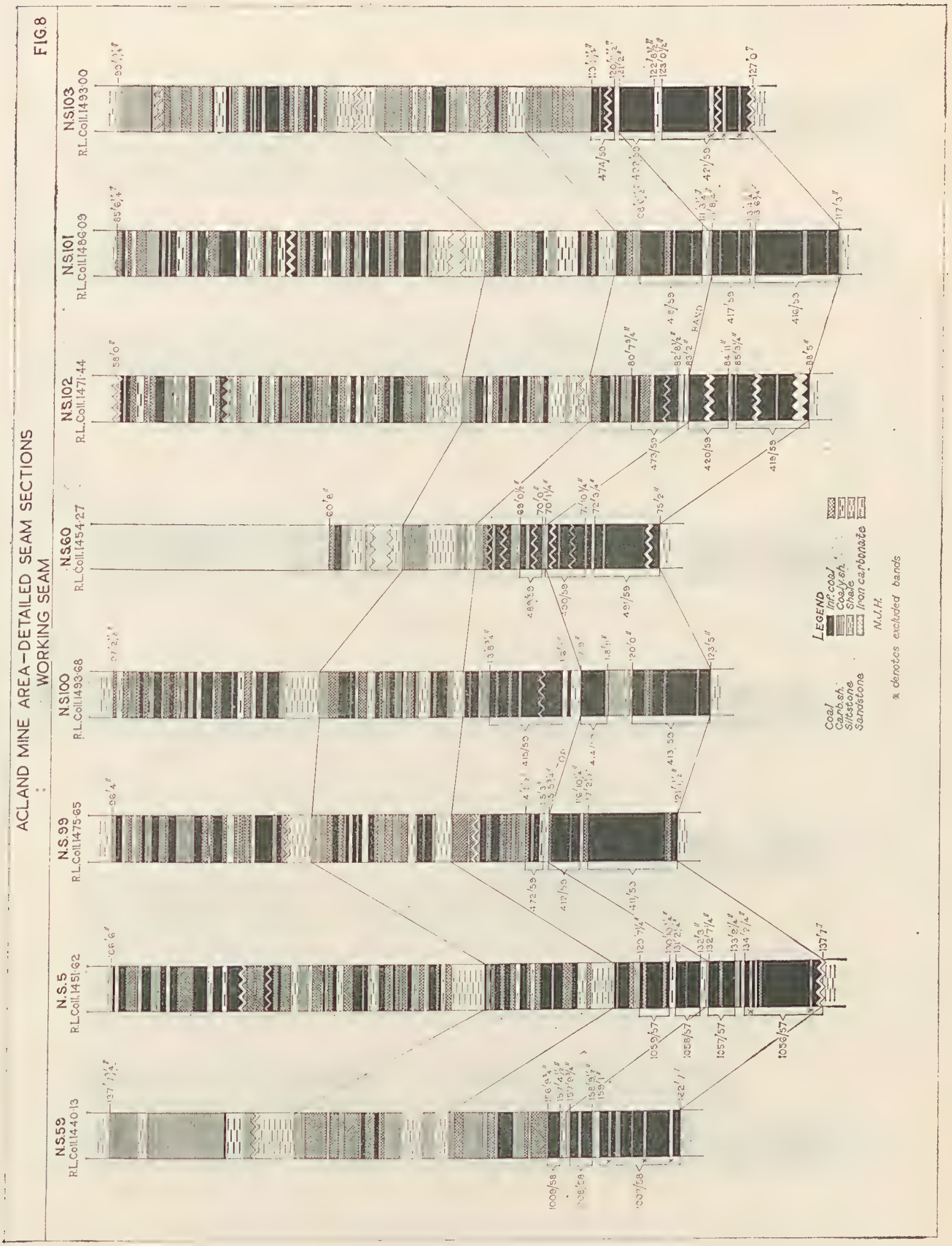
ACLAND MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

FIG.7



ACLAND MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

FIG.8



B

FIG. 9

ACLAND MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

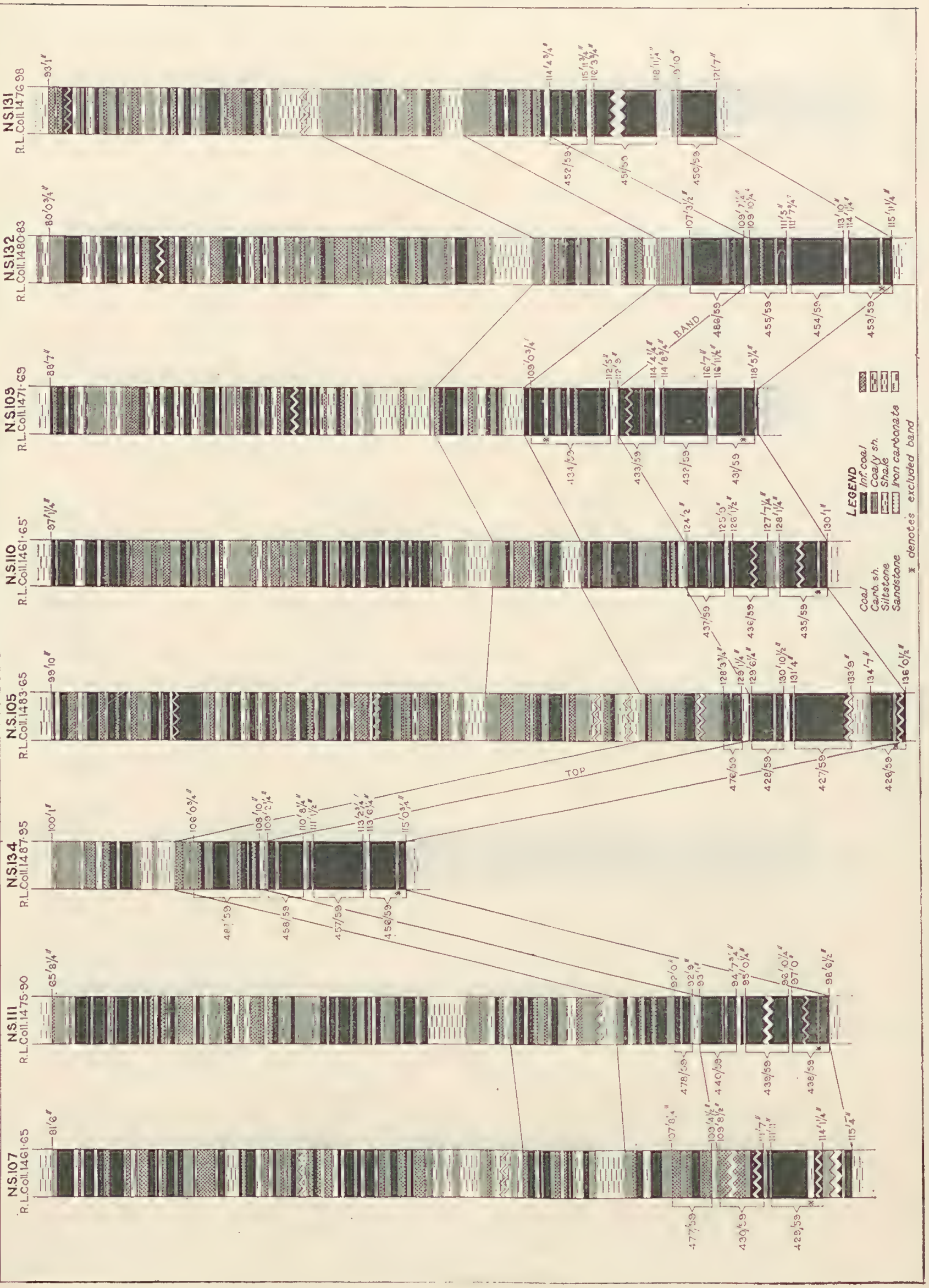


FIG.10

ACLAND. MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

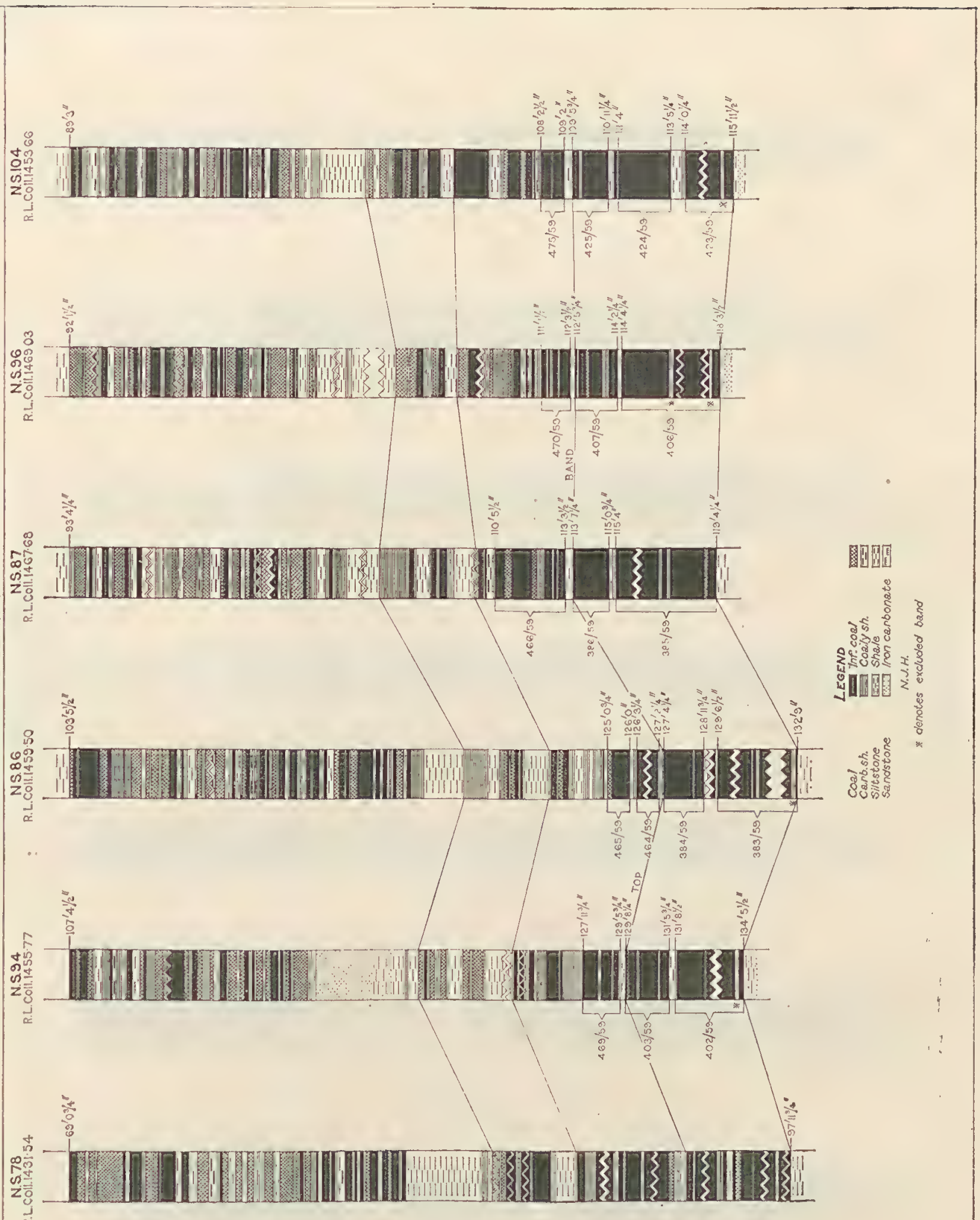


FIG 11

ACLAND MINE AREA–DETAILED SEAM SECTIONS
WORKING SEAM

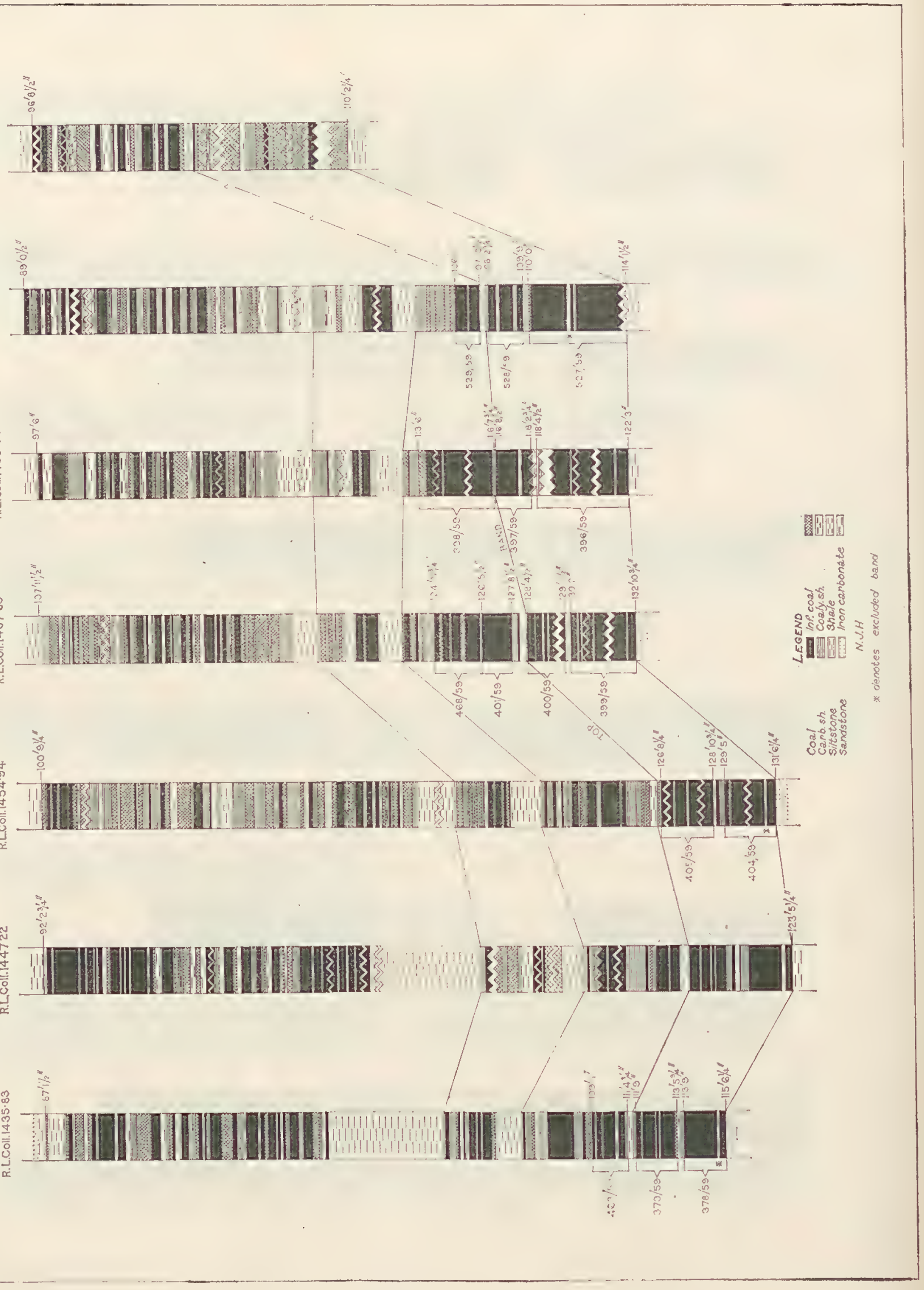
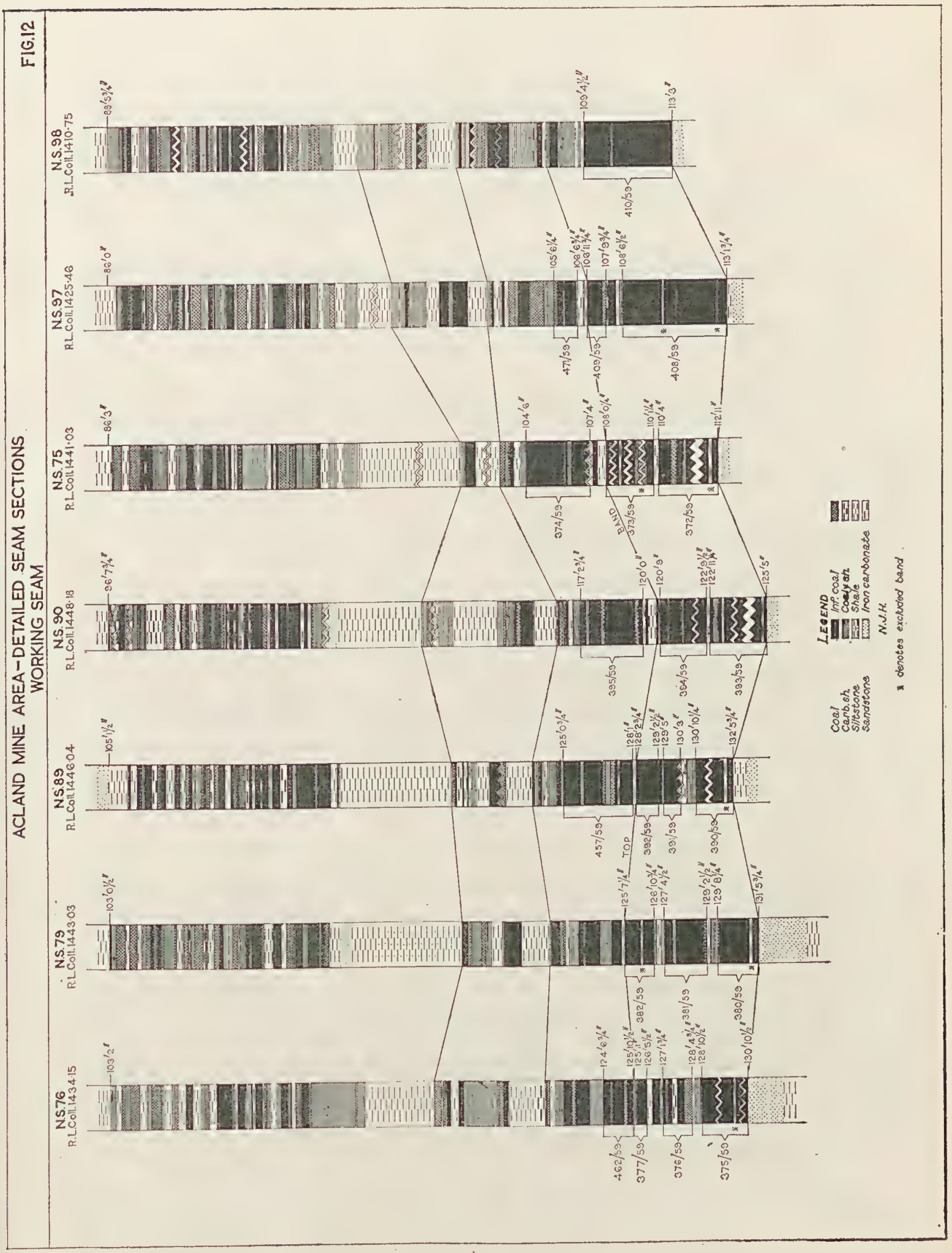


FIG.12

ACLAND MINE AREA–DETAILED SEAM SECTIONS
WORKING SEAM



C

TABLE OF RECOVERIES AND ANALYSES

N.S. Bore No.	Coal Section Depth Ft. in. Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
5	129 7¼—130 10¾	1 3½	100	1059/57	4·0	36·7	33·3	26·0	20·31	0·44	10230	1·433	..
	131 2¼—132 3	1 0¾	100	1058/57	3·8	37·9	34·3	24·0		0·40	10440	1·417	..
	132 7¼—134 1¾	1 6½	100	1057/57	4·3	37·9	34·0	23·8		0·39	10530	1·418	..
	134 2¼—137 7	3 4¾	96·5	1056/57	4·1	40·9	39·6	15·4		0·45	11660	1·342	..
6	178 3 —179 3½	1 0½	100	1091/57	..	..	..	26·7	..	..	..	..	..
	180 0 —181 3¾	1 3¾	100	1061/57	4·1	37·4	37·5	21·0	21·37	0·66	11070	1·384	..
	182 6 —186 3	3 9	100	1060/57	4·8	37·5	36·2	21·5		0·51	10780	1·388	..
7	137 10 —138 7	0 9	100	1064/57	3·6	37·1	32·1	27·2	18·22	0·38	10060	1·424	..
	138 11¾—140 1	1 1¼	100	1063/57	3·1	35·9	32·3	28·7		0·34	9780	1·466	..
	140 10¼—145 0	4 1¾	89·5	1062/57	3·7	41·7	40·8	13·8		0·33	11910	1·343	..
8	101 5¼—103 4	1 10¾	100	1068/57	3·6	34·1	26·5	35·8	..	0·45	8670	1·513	..
	103 4 —104 5¼	1 1¼	92·5	1067/57	4·4	39·8	37·2	18·6	17·34	0·41	11230	1·379	..
	105 0 —106 2	1 2	93	1066/57	4·1	39·1	37·5	19·3		0·41	12230	1·384	..
	106 7¾—110 2	3 6¼	100	1065/57	4·5	39·9	39·6	16·0		0·42	11580	1·354	..
9	130 5¾—133 9	3 3¼	100	1071/57	3·3	37·5	31·0	28·2	19·32	0·36	9910	1·460	..
	134 4½—135 11	1 6½	100	1070/57	3·6	40·7	37·3	18·4		0·47	11400	1·384	..
	136 1 —140 4¾	4 3¾	92·5	1069/57	4·0	42·1	41·3	12·6		0·35	12090	1·322	..
10	137 2½—141 3½	4 1	97	1072/57	4·8	38·8	38·4	18·0	18·0	0·52	11280	1·361	..
11	92 1¾— 95 2¾	3 1	77	1074/57	3·8	37·0	33·0	26·2	20·02	0·33	10190	1·444	..
	97 2¼—100 4¼	3 2	97·5	1073/57	4·3	42·1	39·0	14·6		0·37	11950	1·339	..
12	96 11¾—101 6½	4 6¾	87	1075/57	3·8	39·9	37·1	19·2	19·2	0·37	10940	1·380	..
13	68 2 — 70 3¾	2 1¾	100	1078/57	3·2	37·6	31·8	27·4	20·48	0·43	9720	1·463	..
	70 8¾— 71 9¾	1 1	100	1077/57	4·9	39·1	37·7	18·3		0·43	11090	1·381	..
	72 3¾— 76 0	3 8¼	95·5	1076/57	4·7	39·8	38·4	17·1		0·44	11340	1·353	..
14	140 4 —142 8¼	2 4¼	96·5	1082/57	4·1	31·9	26·2	37·8	..	0·42	8160	1·565	..
	142 8¼—144 6¾	1 10½	91	1081/57	3·4	38·1	32·0	26·5	20·76	0·40	10180	1·436	..
	144 8¼—146 1½	1 5¼	94	1080/57	3·9	33·7	29·0	33·4		0·31	8870	1·514	..
	146 4 —150 2½	3 10½	94	1079/57	4·0	41·3	41·4	13·3		0·47	12070	1·340	..
15	66 1 — 69 11¼	3 10¼	90·5	1705/58	3·3	40·5	38·7	17·5	19·18	0·46	11660	1·353	..
	70 3¾— 71 1¾	0 10	100	1724/58	..	..	..	26·4		..	..	..	..
	71 3¾— 74 0	2 8¼	97	1706/58	3·7	39·2	37·6	19·5		0·42	11090	1·380	..
16	57 8¼— 61 4½	3 8¼	93	1707/58	3·5	39·2	37·1	20·2	20·34	0·40	11130	1·380	..
	62 5½— 65 9	3 3½	100	1708/58	3·6	37·8	38·1	20·5		0·44	10860	1·392	..
17	68 4½— 71 1½	2 9	100	1725/58	..	..	..	28·8	25·01	..	..	..	..
	73 6¾— 76 4½	2 9¾	100	1709/58	3·6	38·0	37·1	21·3		0·42	10780	1·398	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Coal Section Depth Ft. in. Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
18	73 10 — 75 2½	1 4½	98·5	1710/58	2·4	32·4	29·5	35·7	..	0·43	9050	1·512	..
	75 10 — 76 11	1 1	100	1711/58	3·1	40·1	38·8	18·0	24·02	0·49	11570	1·361	..
	77 8¾ — 81 2½	3 5¾	94	1712/58	3·3	36·2	34·6	25·9		0·46	10010	1·445	..
19	75 4 — 76 9¾	1 5¾	94·5	1713/58	3·3	32·4	33·6	30·7	..	0·57	9570	1·474	..
	77 1¼ — 78 4½	1 3¼	95	1714/58	3·6	37·0	36·2	23·2	22·53	0·69	10610	1·403	..
	79 3¾ — 82 10½	3 6¾	92	1715/58	3·3	38·1	36·5	22·1		0·54	10740	1·396	..
21	30 8 — 33 3¼	2 7¼	91	1716/58	3·1	34·9	32·0	30·0	..	0·42	9640	1·465	..
	34 2¾ — 37 7½	3 4¾	87·5	1717/58	3·9	35·5	34·5	26·1	..	0·41	9900	1·441	..
22	37 2¾ — 40 4	3 1¼	97·5	1718/58	3·0	36·1	32·4	28·5	..	0·45	9910	1·444	..
	41 4 — 44 6¾	3 2¾	86	1719/58	3·6	36·9	34·7	24·8	..	0·44	10160	1·422	..
23	58 4½ — 59 4½	1 0	96	1720/58	4·0	39·5	43·0	13·5	24·17	0·65	12100	1·327	..
	59 11½ — 63 5¾	3 6¼	96	1721/58	3·7	35·1	34·0	27·2		0·46	9900	1·451	..
24	70 2½ — 73 0¼	2 9¾	94	1722/58	3·2	35·6	36·5	24·7	23·88	0·56	10500	1·422	..
	73 4¼ — 76 3½	2 11¼	90	1723/58	3·2	36·7	37·0	23·1		0·40	10480	1·405	..
25	162 11¼ — 164 3	1 3¾	93·5	717/58	3·6	37·6	35·9	22·9	..	0·49	10620	1·407	..
	164 5½ — 166 3	1 9½	95·5	716/58	3·4	34·7	32·4	29·5	..	0·51	9780	1·465	..
	166 6 — 167 10	1 4	90·5	715/58	4·4	30·8	27·6	37·2	..	0·95	8300	1·557	..
	167 10½ — 172 6¾	4 8¼	98	714/58	4·1	39·4	38·6	17·9	17·9	0·41	11320	1·375	..
29	81 3½ — 84 0	2 8½	94	732/58	4·0	38·6	35·1	22·3	15·86	0·64	10730	1·491	..
	84 7 — 88 7	4 0	90·5	731/58	4·7	40·1	43·7	11·5		0·51	12280	1·324	..
30	90 6¼ — 91 7¾	1 1½	100	736/58	2·8	39·3	33·4	24·5	18·28	0·50	10710	1·412	..
	92 1 — 93 10	1 9	95	735/58	3·3	41·2	38·8	16·7		0·50	12000	1·350	..
	94 4 — 94 9¾	0 5¾	87	734/58	3·7	40·2	43·5	12·6		0·62	12380	1·324	..
	95 4¼ — 97 2¼	1 10	95·5	733/58	3·1	42·4	37·1	17·4		0·71	11760	1·435	..
31	91 8½ — 92 9¾	1 1¼	100	740/58	2·9	36·5	29·1	31·5	..	0·39	9690	1·470	..
	93 0 — 95 9¾	2 9¾	85	739/58	3·4	37·6	32·5	26·5	19·20	0·45	10100	1·441	..
	96 0¼ — 98 1½	2 1¼	80	738/58	3·4	41·5	39·2	15·9		0·43	11850	1·438	..
	98 10 — 100 3	1 5	88	737/58	3·6	43·4	43·4	9·6		0·49	12860	1·373	..
32	87 0 — 88 7½	1 7½	95	743/58	3·6	38·0	33·4	24·5	20·73	0·51	10540	1·510	..
	89 11¾ — 92 5¾	2 6	98·5	742/58	4·2	41·1	39·1	15·6		0·47	11800	1·432	..
	93 2 — 94 4½	1 2½	93	741/58	3·6	37·4	31·9	27·1		0·39	9930	1·451	..
35	39 0 — 41 6	2 6	89·5	747/58	4·9	38·7	37·7	18·7	..	0·45	11210	1·455	..
	42 4 — 43 11	1 7	88	746/58	4·2	41·8	39·1	14·9	..	0·50	11980	1·339	..
	62 11 — 63 7	0 8	62·5	1447/59	3·5	36·2	36·0	24·3	18·81	0·49	10660	1·403	..
	64 1 — 66 0½	1 11½	72·5	1446/59	3·1	39·9	34·9	22·1		0·42	11030	1·382	..
	66 2½ — 68 1	1 10½	73·5	1445/59	4·0	40·1	40·5	15·4		0·55	11830	1·343	..
36	48 10¼ — 51 6	2 7¾	100	749/58	3·4	37·7	34·3	24·6	..	0·50	10720	1·400	..
	53 7 — 55 6	1 11	79·5	748/58	3·9	42·4	39·4	14·3	..	0·50	12090	1·413	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

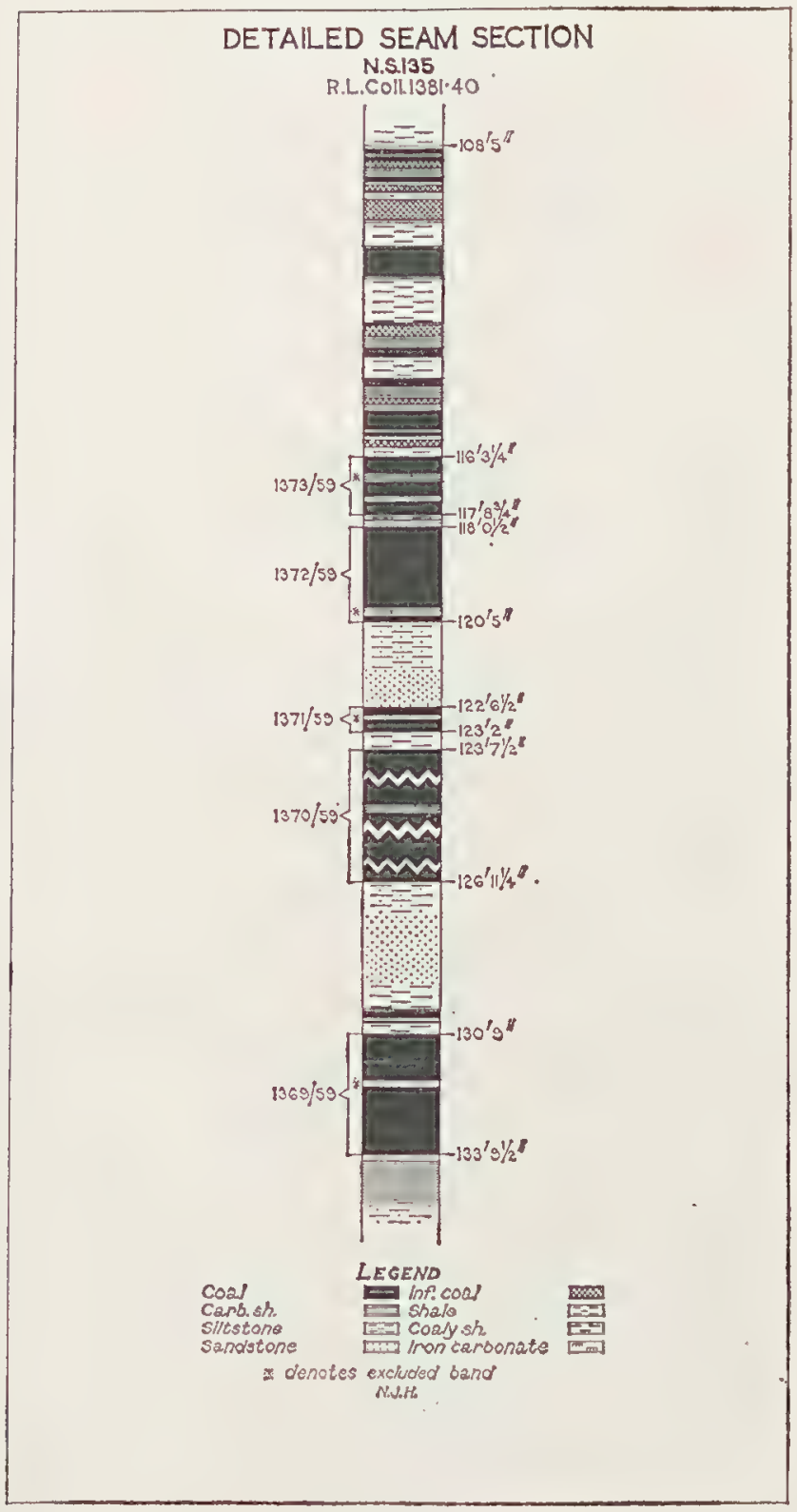
N.S. Bore No.	Coal Section Depth Ft. in. Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
38	135 1¼—137 9¼	2 8	97·5	720/58	4·5	34·3	29·8	31·4	..	0·62	9260	1·575	..
	138 2 —139 1	0 11	100	719/58	4·4	42·3	39·5	13·8	18·38	0·59	12160	1·397	..
	139 3 —143 3½	4 0½	98·5	718/58	4·1	38·7	37·8	19·4		0·59	11000	1·381	..
39	152 10 —153 7	0 9	100	723/58	4·8	34·0	30·9	30·3	..	0·52	9500	1·477	..
	153 10½—155 6½	1 8	100	722/58	4·6	36·6	34·2	24·6	18·66	0·44	10300	1·426	..
	155 8½—159 7¼	3 10¾	82	721/58	4·8	39·6	39·5	16·1		0·52	11630	1·346	..
40	174 4¼—175 4½	1 0¼	100	726/58	4·3	33·7	30·3	31·7	..	0·47	9250	1·585	..
	175 9¼—176 11¾	1 2½	100	725/58	4·8	38·0	37·4	19·4	18·44	0·50	11220	1·461	..
	177 7½—182 6¼	4 10¾	100	724/58	4·9	38·2	38·8	18·1		0·44	11380	1·454	..
41	150 7¼—152 0¼	1 5	83·5	730/58	4·4	39·0	35·5	21·1	18·19	0·36	10870	1·392	..
	152 4 —154 3½	1 11½	96	729/58	4·8	39·1	38·2	17·9		0·49	11290	1·360	..
	154 8 —155 7½	0 11½	87	728/58	4·3	40·9	40·8	14·0		0·45	12090	1·420	..
	156 1¼—157 10½	1 9¼	95·5	727/58	5·3	40·4	41·5	12·8		0·56	12230	1·404	..
59	156 9¾—157 4½	0 6¾	100	1009/58	3·6	39·4	37·3	19·7	18·67	0·43	12950	1·371	..
	157 9¾—158 9½	0 11¾	100	1008/58	4·1	36·7	34·8	24·4		0·50	10270	1·425	..
	159 1 —162 7	3 6	100	1007/58	4·6	38·1	40·4	16·9		0·50	11350	1·362	..
60	69 0½— 70 0	0 11½	78·5	489/59	..	..	..	27·7	..	..	..	..	..
	70 1¼— 71 10¾	1 9½	86	490/59	3·9	36·2	34·2	25·7	20·5	0·46	10160	1·433	..
	72 3¼— 75 2	2 10¾	93	491/59	3·9	39·8	38·6	17·7		0·43	11430	1·365	..
75	104 6 —107 4	2 10	97	374/59	2·8	37·7	32·8	26·7	..	0·44	10300	1·425	Cw
	108 0¼—110 1¼	2 1	74	373/59	4·0	35·0	32·0	29·0	25·35	0·66	10151	1·466	Cw
	110 4 —112 11	2 7	84	372/59	3·5	38·7	35·4	22·4		0·58	10860	1·401	Cw
76	124 6¾—125 10½	1 3¾	100	462/59	..	..	..	25·2	..	..	..	..	..
	125 11 —126 5½	0 6½	100	377/59	5·0	35·9	34·6	24·5	19·18	0·51	10220	1·418	Af
	127 1¾—128 4¾	1 3	100	376/59	4·5	38·2	33·0	24·3		0·49	10310	1·423	Af
	128 10½—130 10½	2 0	91	375/59	5·2	40·6	43·6	10·6		0·56	12330	1·321	Cw
77	109 11 —111 4¾	1 5¾	100	463/59	..	..	..	28	..	..	..	..	..
	111 9 —113 5¾	1 8¾	100	379/59	4·6	35·7	34·0	25·7	21·76	1·16	10150	1·431	Af
	113 9 —115 6¼	1 9¼	100	378/59	4·5	41·0	41·8	12·7		0·54	12170	1·324	Cw
79	125 7¼—126 10¾	1 3½	97	382/59	3·7	37·1	33·2	26·0	22·16	0·55	10300	1·421	Af
	127 4½—129 2½	1 10	100	381/59	4·5	35·6	35·8	24·1		0·49	10370	1·416	Af
	129 8¼—131 5¾	1 9½	100	380/59	4·3	38·7	39·6	17·4		0·52	11510	1·355	Af
86	125 0¾—126 0	0 11¼	100	465/59	..	..	..	24·6	..	..	..	..	..
	126 3¼—127 2¼	0 11	82	464/59	..	..	..	36·9	..	..	..	..	..
	127 4¼—128 11¾	1 7½	100	384/59	3·8	35·8	33·9	26·5	21·06	0·43	10040	1·440	Af
	129 6½—132 9	3 2½	70	383/59	3·3	40·2	38·2	18·3		0·43	11500	1·370	Af
87	110 5½—113 3½	2 10	100	466/59	..	..	..	32·7	..	..	..	..	..
	113 7¼—115 0¾	1 5½	100	386/59	3·9	38·2	35·8	22·1	20·92	0·44	10780	1·400	Af
	115 4 —119 4¼	4 0¼	95·5	385/59	3·6	39·1	36·8	20·5		0·45	11170	1·374	Af

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Coal Section Depth Ft. in. Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
88	106 11 —107 10½	0 11½	100	529/59	3·5	35·5	29·1	32·1	..	0·38	9170	1·483	..
	108 2¾—109 9	1 6¼	100	528/59	3·6	39·2	35·0	22·2	15·19	0·50	10720	1·391	..
	110 0 —114 1½	4 1½	95	527/59	4·1	42·8	40·5	12·6		0·56	11860	1·311	..
89	125 0¾—128 1	3 0¼	100	467/59	..	..	..	29·9		..	..	..	..
	128 2¾—129 2½	0 11¾	100	392/59	5·0	40·0	42·1	12·9	22·15	0·46	12070	1·332	Af/Cw
	129 5 —130 3	0 10	90	391/59	4·5	41·9	32·8	20·8		0·46	10870	1·389	Af
	130 10¼—132 5¾	1 7½	87	390/59	4·8	40·5	40·7	14·0		0·53	11870	1·332	Af
90	117 2¾—120 0	2 9¼	100	395/59	3·9	36·8	31·2	28·1	..	0·42	9790	1·451	Af
	120 9 —122 9½	2 0½	92	394/59	4·9	37·0	37·3	20·8	24·25	0·47	10670	1·391	Af
	122 11¼—125 5	2 5¾	76·5	393/59	4·7	34·6	33·7	27·0		0·40	9720	1·445	Af
91	113 6 —116 7¾	3 1¾	92	398/59	3·6	37·1	34·2	25·1		0·46	10410	1·419	Af
	116 8½—118 2¾	1 6¼	94·5	397/59	4·4	36·2	33·8	25·6	21·42	0·44	9960	1·446	Af
	118 4½—122 3	3 10½	77·5	396/59	4·4	39·9	38·9	16·8		0·53	11580	1·359	Af/Cw
92	124 5¾—126 5½	1 11¾	100	468/59	..	..	..	29·4	..	..	..	..	..
	126 5½—127 8½	1 3	100	401/59	4·6	36·6	34·7	24·1		0·50	10350	1·422	Af
	128 4½—129 11½	1 7	83	400/59	4·9	35·9	35·5	23·7	22·18	0·46	10180	1·431	Af
	130 2 —132 10¾	2 8¾	88	399/59	4·8	34·0	40·8	20·4		0·44	10750	1·397	Af
94	127 11¾—129 5¾	1 6	100	469/59	..	..	..	30·9	..	..	..	..	..
	129 8¼—131 5¾	1 9½	100	403/59	4·2	35·2	31·6	29·0	24·67	0·45	9650	1·457	Af
	131 8½—134 5½	2 9	92·5	402/59	4·0	37·8	36·7	21·5		0·41	10860	1·391	Af
95	126 8¼—128 10¾	2 2½	90·5	405/59	4·7	39·0	36·2	20·1	16·79	0·57	10950	1·385	Af
	129 5 —131 6¼	2 1¼	93	404/59	5·0	40·5	41·7	12·8		0·45	12020	1·326	Af
96	111 1½—112 3½	1 2	100	470/59	..	..	..	29·0	..	..	..	..	..
	112 5¾—114 2¼	1 8½	100	407/59	3·7	35·6	31·9	28·8	..	0·44	9730	1·450	Af
	114 4¼—118 3½	3 11¼	92·5	406/59	4·0	41·9	41·2	12·9	12·9	0·61	12190	1·328	Cw
97	105 6½—106 6¾	1 0½	100	471/59	..	..	..	29·6	..	..	..	..	..
	106 11¾—107 9¾	0 10	100	409/59	3·6	39·0	39·4	18·0	13·37	0·49	11550	1·355	Cw
	108 6½—113 1¾	4 7¼	98·5	408/59	3·5	43·1	41·3	12·1		0·48	12450	1·303	Cw
98	109 4½—113 3	3 10½	100	410/59	3·5	41·3	40·3	14·9	14·9	0·47	12060	1·327	Cw
99	114 5½—115 3	0 9½	100	472/59	..	..	..	31·1	..	..	..	..	..
	115 5¾—116 10¼	1 4½	100	412/59	3·4	40·2	36·6	19·8	17·26	0·49	11100	1·379	Cw
	117 2½—121 1½	3 11	100	411/59	3·6	42·3	40·3	13·8		0·44	12160	1·322	Af/Cw
100	113 8¾—116 11	3 2¼	97·5	415/59	3·4	38·1	33·7	24·8		0·43	10650	1·419	Af
	117 9 —118 11	1 2	100	414/59	4·8	38·8	37·9	18·5	22·81	0·62	11170	1·378	Af
	120 0 —123 5	3 5	99·5	413/59	4·2	38·0	35·1	22·7		0·55	10580	1·410	Af
101	108 6½—111 3¼	2 8¾	100	418/59	3·7	36·7	31·4	28·2	..	0·42	9920	1·450	Af
	111 8¼—113 4¼	1 8	95	417/59	3·8	38·0	36·8	21·4	17·73	0·64	10790	1·398	Af/Cw
	113 6¾—117 3	3 8¼	99·5	416/59	4·1	40·4	39·0	16·5		0·46	11460	1·366	Af/Cw

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Coal Section Depth Ft. in. Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
102	80 7¾— 82 8½	2 0¾	94	473/59	..	..	..	27·9		..	..	..	..
	83 2 — 84 11	1 9	85·5	420/59	3·7	40·4	36·3	19·6	19·4	0·45	11270	1·374	Af
	85 3¼— 88 5	3 1¾	76	419/59	3·9	41·7	39·2	15·2		0·47	11910	1·345	Af/Cw
103	119 11¼—120 11½	1 0¼	83·5	474/59	..	..	..	30·0	..	..	..	..	..
	121 2 —122 8½	1 6½	100	422/59	3·8	39·1	34·2	22·9	14·11	0·46	10660	1·406	Af
	123 0½—127 0	3 11½	92	421/59	4·3	41·7	43·3	10·7		0·46	12490	1·311	Cw
104	108 2½—109 2	0 11½	100	475/59	..	..	..	26·8		..	..	..	..
	109 5¾—110 11¼	1 5½	100	425/59	4·0	37·8	35·9	22·3	15·37	0·45	10750	1·396	Af
	111 4 —113 5¼	2 1¼	100	424/59	4·1	42·0	41·3	12·6		0·45	12290	1·322	Af/Cw
	114 0¼—115 11½	1 11¼	90·5	423/59	4·5	42·8	45·0	7·7		0·50	12940	1·287	Cw
105	128 3¾—129 1¼	0 9½	100	476/59	..	..	..	31·4	..	..	..	..	..
	129 6¼—130 10½	1 4¼	100	428/59	3·6	37·9	36·0	22·5	13·16	0·44	10780	1·403	Af
	131 4 —133 9	2 5	93	427/59	4·1	41·5	42·4	12·0		0·44	12390	1·314	Af/Cw
	134 7 —136 0½	1 5½	93	426/59	4·9	41·0	46·3	7·8		0·50	12870	1·293	Af
107	107 8¼—109 4½	1 8¼	100	477/59	..	..	..	30·2	..	..	..	..	..
	109 8½—111 7	1 10½	75·5	430/59	4·2	36·7	36·5	22·6	19·64	0·41	10390	1·417	Af
	111 11 —114 1¼	2 2¼	94·5	429/59	3·7	40·8	38·9	16·6		0·38	11310	1·372	Af
109	109 0¾—112 5	3 4¼	98	434/59	3·8	35·0	31·9	29·3	..	0·43	9380	1·470	Af
	112 9 —114 4¼	1 7¼	93·5	433/59	4·1	36·8	34·3	24·8		0·35	9990	1·426	Af
	114 8¾—116 7	1 10¼	96·5	432/59	4·1	40·5	39·0	16·4	16·20	0·47	11480	1·348	Af/Cw
	116 11½—118 7	1 6½	100	431/59	5·2	40·7	47·1	7·0		0·45	12720	1·285	Cw
110	124 2 —125 9	1 7	100	437/59	4·3	36·3	34·8	24·6		0·36	10110	1·425	Af
	126 1½—127 7¼	1 5¾	91·5	436/59	4·0	40·3	39·4	16·3	18·92	0·41	11370	1·347	Af
	128 1¼—130 1	1 11¾	91·5	435/59	4·3	41·9	42·5	11·3		0·40	12110	1·312	Af/Cw
111	92 0 — 92 9	0 9	100	478/59	..	..	..	32·5	..	..	..	..	..
	93 1 — 94 7¾	1 6¾	100	440/59	3·9	37·7	34·4	24·0	17·42	0·39	10320	1·418	Af
	95 0¼— 96 10¼	1 10	86·5	439/59	5·0	38·9	40·7	15·4		0·42	11400	1·367	Af
	97 0 — 98 6	1 6	93	438/59	4·4	40·6	40·9	14·1		0·46	11690	1·338	Af/Cw
131	114 4¾—115 11¾	1 7	100	452/59	4·0	36·7	35·5	23·8		0·20	10320	1·420	Af
	116 3¾—118 11¼	2 7½	82·5	451/59	4·2	40·8	41·0	14·0	15·89	0·43	12020	1·336	Cw
	119 10 —121 7	1 9	100	450/59	5·0	40·5	42·9	11·6		0·38	12120	1·327	Af/Cw
132	107 3½—109 7¼	2 3¾	100	486/59	..	..	..	25·2		..	..	..	..
	109 10¼—111 5	1 6¾	100	455/59	3·6	39·6	35·6	21·2	17·34	0·40	11160	1·389	Af
	111 7¾—113 10	2 2¼	100	454/59	4·0	42·0	40·9	13·9		0·50	11780	1·327	Cw
	114 1¼—115 11¼	1 10	100	453/59	4·8	41·8	45·7	7·7		0·50	12710	1·296	Cw
134	106 0¾—108 10	2 9¼	99·5	487/59	..	..	..	31·5	..	..	..	..	..
	109 2¼—110 8¼	1 6	100	458/59	3·7	37·6	35·6	23·1	13·28	0·36	10460	1·414	Af
	111 1½—113 2¾	2 1¼	100	457/59	4·0	42·4	42·7	10·9		0·35	12430	1·310	Cw
	113 6¼—115 0¾	1 6½	98·5	456/59	4·6	42·4	46·0	7·0		0·50	12720	1·286	Cw



APPENDIX
BOREHOLE N.S. 135

During wet weather from 3rd to 5th December, 1958, when other boresites were inaccessible, an exploratory borehole, N.S. 135, was drilled to a depth of 171 ft. 5 in. on a stock route at the south-western corner of portion 3679, parish of Watts, approximately one mile west of Acland railway station.

A sequence of interbedded coal and shale bands was penetrated from 50 ft. to 120 ft. 5 in. The coal section at the base of this sequence (116 ft. 3¼ in. to 120 ft. 5 in.) is comparable in most respects to the worked section in Acland Colliery. However, the "bottom coal" has decreased in thickness and the "top coal" is banded and of poor quality. Below the above coaly sequence two other coal sections were penetrated (122 ft. 6½ in. to 126 ft. 11¼ in. and 130 ft. 9 in. to 133 ft. 9½ in.). The section comparable to the Acland working seam appears to offer the best prospects and further drilling in the area is justified.

TABLE OF RECOVERIES AND ANALYSES

N.S. Bore No.	Coal Section Depth				Sample Thickness		Recovery Percentage	G.S. Sample No.	Proximate Analysis				Sulphur	Calorific Value	Specific Gravity
	Ft.	in.	Ft.	in.	Ft.	in.			Moist. %	Vol. Mat. %	F.C. %	Ash %	%	B.T.U.s/lb.	
135	130	9	—133	9¼	3	0¼	100	1369/59	4·7	36·7	36·5	22·1	0·55	10640	1·413
	123	7½	—126	11¼	3	3¾	80·5	1370/59	4·3	35·6	34·1	26·0	0·47	9990	1·455
	122	6½	—123	2	0	7¼	100	1371/59	5·6	36·8	42·9	14·7	0·44	11460	1·341
	118	0½	—120	5	2	4¼	100	1372/59	4·8	38·6	40·5	16·1	0·38	11470	1·346
	116	3¼	—117	8¾	1	5¼	98·5	1373/59	4·2	36·1	33·5	26·2	0·36	10020	1·431

S. G. Reid, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 315

COAL RESOURCES, DARLING DOWNS (OAKEY) COALFIELD

Part 3. Sugarloaf Mine Area

Part 4. Willeroo Mine Area

By D. C. MENGEL, B.Sc., Geologist

BRISBANE
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1963

COAL RESOURCES, DARLING DOWNS (OAKEY) COALFIELD, SUGARLOAF MINE AREA

By D. C. MENGEL, B.Sc., Geologist

SUMMARY

Diamond drilling to establish reserves in the Sugarloaf Mine Area was undertaken during 1958-9. Fifty-seven boreholes, totalling 11,856 ft. 6 in. were completed.

Drilling in the area west of the operating colliery on C.M.L. 81 was designed to test the working seam. In the undeveloped southern area, however, two lower seams also showed workable sections and were tested with highly satisfactory results.

This report describes the seams in some detail and traces variation in their sections throughout the area drilled. It also refers to the effects of Tertiary erosion of the working seam.

Assessment of the results of drilling has established the following measured reserves:—

C.M.L. 81—

	Tons
Sugarloaf working seam (emergency drilling)	150,000
Sugarloaf working seam	1,970,000
C.P.A. 29—	
Sugarloaf working seam	450,000
Sabine top seam	320,000
Sabine bottom seam	890,000
Total	3,780,000

INTRODUCTION

Sugarloaf Colliery is located approximately one and a half miles in a south-south-easterly direction from Acland Railway Station. Sugarloaf Colliery Limited hold Coal Mining Leases 81, 113, 114, 125 and Coal Mining License 29 (Toowoomba).

An emergency drilling programme (boreholes N.S. 1-4 inclusive), carried out to the south of the colliery, is the subject of an earlier report (Hawthorne, 1960).

An extensive shallow diamond drilling programme, using the Department of Mines' Sullivan 37 drilling plant, was commenced on 7th March, 1958 and continued at intervals for periods totalling 40 weeks until 22nd September, 1959. Interruption of the programme was due to the need to fit in drilling on cultivated land with crop rotation.

Fifty-seven boreholes, including four redrills, were completed. This total includes five boreholes which were sited near the common boundary of two mine areas—Sugarloaf (C.P.A. 29) and Willeroo (C.P.A. 27)—and thus must be considered in estimating coal reserves in both areas. Depths ranged from 131 ft. 2 in. (N.S. 66) to 403 ft. 5 in. (N.S. 46) and aggregate footage was 11,856 ft. 6 in. of which 6,464 ft. 1 in. was cored.

Bores were sited, where possible, at the intersections of a 10 ch. grid. Some modification of this plan was necessary due to owners' use of cultivated land.

Drilling to the west of the present colliery (in C.M.L. 81) was designed to prove reserves in the Sugarloaf working seam, while the main objective in the new southern area (C.P.A. 29) was to prove reserves in a seam encountered below the Sugarloaf working seam.

This report is accompanied by a table showing the recovery of percentages and results of analyses of borehole seam sections and the following plans and diagrams:—

Figure 1—Plan of Sugarloaf Mine Area (A) showing surface geology, boreholes, limits of mine workings, topography, and boundaries of measured reserves.

Figure 2—Plan of Sugarloaf Mine Area (B) showing boreholes, limits of mine workings, and topography; and a locality plan.

Figure 3—Plan of Sugarloaf Mine Area (C) showing boreholes, topography and boundaries of measured reserves.

Figure 4—Cross-sections.

Figure 5—Diagram of generalised bore section.

Figures 6 and 7—Diagrams of detailed seam sections in boreholes.

Figure 8—Diagram of detailed seam sections in boreholes and in the colliery.

Figures 9-11—Diagrams of detailed seam sections in boreholes.

Plant fossils collected by the writer from N.S. 194 are described by Dr. N. J. de Jersey in an appendix to this report.

COAL MINING DEVELOPMENT

The first Sugarloaf Colliery was opened in 1910 in the Kingsthorpe district and abandoned in 1915. In 1913, the management opened a new colliery near the town of Acland, in subsection 71, portion 801, parish of Watts, on the eastern side of the Oakey-Cooyar Branch Railway.

Two coal sections, which may be correlated with the sections worked in the old Acland Colliery near Beith Siding, were exploited in this new colliery.

Workings were more extensive in the lower section, which is the one worked in the other collieries near Acland.

In 1943, a new tunnel (No. 3 Colliery) was driven to the lower coal section on the western side of the railway. Mining is now confined to this part of the mine area and development is taking place to the north-west.

GENERAL GEOLOGY

The coal bearing strata of the Sugarloaf Mine Area and environs are equivalent to the Walloon Coal Measures of Jurassic age. Except for occasional boulders of sandstone and ironstone, surface exposures of these sub-horizontal beds are practically non-existent owing to poor resistance of the rocks to weathering.

Tertiary basalt, which elsewhere in the district occurs as cappings and flow remnants, is not present as such in the mine area.

In the western part of the mine area the coal measures have been eroded to at least the depth of the coal section worked in the colliery and replaced by a washout of Tertiary age.

SUBSURFACE GEOLOGY

(i) Coal Measures

The coal measures consist of light-grey shales, siltstones and fine grained sandstones, with several coal seams. Thin beds of ironstone and impure limestone (often showing cone-in-cone structure) are also present.

The upper beds of the coal measures have been eroded to an unknown extent and no borehole penetrated to a greater depth than 403 ft. 5 in. (N.S. 46). Consequently their full thickness is not known.

Fossils were not abundant in the bore cores. Nodal diaphragms of *Equisetites* sp. and portion of a sterile frond of *Coniopteris delicatula* (?) have been described (see appendix). *Dicroidium* sp. and *Cladophlebis* sp. have also been identified.

(ii) Coal Seams

In the Sugarloaf Mine Area three coal seams are of economic interest. In this report they are referred to, in descending stratigraphic order, as:—

(*a*) Sugarloaf working seam

(*b*) Sabine top seam

(*c*) Sabine bottom seam

The two lower seams are well developed near Sabine on the Oakey-Cooyar Branch Railway. In the Acland Mine Area and in C.M.L. 81 (Sugarloaf) drilling was designed to prove reserves in the working seam. Most boreholes were of insufficient depth to penetrate the two lower seams. However, in the deeper boreholdes e.g. N.S. 127, 194 (Sugarloaf) and N.S. 5 (Acland), all three seams are recognisable though the Sabine seams seldom show workable sections.

(a) Sugarloaf working seam

The coal section worked in Sugarloaf No. 3 Colliery is the lower part of a sequence of coal and shale bands, which ranges in thickness from 11 ft. (N.S. 47 and 49) to 20 ft. (N.S. 51) and averages 13 ft. A second sequence of coal and shale bands overlies the first at an interval ranging from 9 ft. (N.S. 47 and 124) to 19 ft. (N.S. 205). This upper sequence averages 26 ft. in thickness but increases to 40 ft. in the north-western part of C.M.L. 81 owing to thickening of shale bands.

The strata separating these two coaly sections consists of shale and fine grained sandstone, and also increase in thickness in the north-western part of C.M.L. 81.

The above succession is similar to that in the southern part of Acland C.M.L. 109 (Mengel, 1963).

In the colliery the working seam ranges up to some 8 ft. in thickness. It is equivalent to the Acland working seam, a detailed description of which has been given in a report on that mine area (loc. cit.).

The various units of the Sugarloaf working seam may be identified with the corresponding units of the Acland working seam. One noticeable difference is the greater persistence of the two small shale bands separated by a few inches of coal near the base of the "middle coal." These are the **"twin bands"** recognisable throughout the colliery.

As at Acland the "bottom coal" is more uniform and has a lower ash content than the "middle" and "top coals." In places the "top coal" is not worked and here the "top band" forms the roof of mine workings.

In the south-western parts of the colliery the seam deteriorates due to thinning of coal and increase in the total thickness of shale bands. In the present mine workings to the north-west, a similar increase in the total thickness of shale bands occurs (see underground section C).

In the boreholes in C.M.L. 81, the seam sections are essentially similar to those of the mine workings. The "bottom coal" is again the part most uniform in quality. It ranges in thickness from 1 ft. 9¾ in. (N.S. 53) to 3 ft. 9 in. (N.S. 128) and averages 3 ft. 0 in. The thickness of the "middle coal" that may be worked ranges from 9 in. to 1 ft. 9 in. The "top coal" is widely variable in regard to thickness of coal and number and thickness of shale bands. It is often unworkable but sections ranging up to 3 ft. 3 in. (N.S. 47) do occur.

In N.S. 51, 56, 66, and 205 and westerly from these boreholes, a shale band occurs in the "bottom coal" 1 ft. 0 in. to 1 ft. 6 in. from the base. This band consists of carbonaceous shale or infrequently grey shale and ranges from a few inches to 1 ft. 0 in. (N.S. 57) in thickness. A similar band in the "bottom coal" was noted in a number of boreholes in C.M.L. 109 (Mengel, 1963).

In C.P.A. 29, sections of the Sugarloaf working seam were of workable thickness in most boreholes.

FIG.1

ACLAND A

3975

3421

3424

3852

3655

3768

3851

801

OAKEY

COOYAR

BRANCH

RLY.

N.S.52 R.L.Coll.1370·55 R.L.Btm.1198·88

N.S.51 R.L.Coll.1390·00 R.L.Btm.1205·00

N.S.122 R.L.Coll.1399·43 R.L.Btm.1213·18

N.S.49 R.L.Coll.1404·70 R.L.Btm.1230·12

N.S.53 R.L.Coll.1413·13 R.L.Btm.1256·46

N.S.136 R.L.Coll.1409·70 R.L.Btm.1253·70

N.S.50 R.L.Coll.1408·25 R.L.Btm.1238·33

N.S.128 R.L.Coll.1404·88 R.L.Btm.1240·13

N.S.58 R.L.Coll.1390·95 R.L.Btm.1201·95

N.S.127 R.L.Coll.1395·88 R.L.Btm.1199·05

N.S.56 R.L.Coll.1399·65 R.L.Btm.1209·73

N.S.72 R.L.Coll.1389·97 R.L.Btm.1210·97

N.S.124 R.L.Coll.1388·68 R.L.Btm.1248·60

N.S.47 R.L.Coll.1388·01 R.L.Btm.1190·76

N.S.57 R.L.Coll.1377·30 R.L.Btm.1196·80

P.D.No.4

N.S.126 R.L.Coll.1371·54 R.L.Btm.1236·87

P.D.No.11

N.S.55 R.L.Coll.1366·10 R.L.Btm.1260·27

N.S.121 R.L.Coll.1369·40 R.L.Btm.1209·65

N.S.67 R.L.Coll.1365·77 R.L.Btm.1201·69

N.S.54 R.L.Coll.1359·46 R.L.Btm.1208·96

N.S.68 R.L.Coll.1363·48 R.L.Btm.1221·28

N.S.48,66 R.L.Coll.1361·54 R.L.Btm.1230·37

N.S.125 R.L.Coll.1363·48 R.L.Btm.1169·73

P.D.No.12

N.S.46 R.L.Coll.1370·60 R.L.Btm.967·18

N.S.200 R.L.Coll.1350·39 R.L.Btm.1185·39

N.S.198 R.L.Coll.1355·10 R.L.Btm.1163·10

N.S.195

N.S.197 R.L.Coll.1354·66 R.L.Btm.1195·99

P.D.No.14

P.D.No.13

N.S.123 R.L.Coll.1371·83 R.L.Btm.1223·41

N.S.120

N.S.205 R.L.Coll.1350·66 R.L.Btm 1195·00

N.S.196 R.L.Coll.1354·01 R.L.Btm.1168·76

N.S.194 R.L.Coll.1357·11 R.L.Btm.1161·03

N.S.199 R.L.Coll.1354·44 R.L.Btm.1051·27

P.D.No.8

P.D.No.100

P.D.No.90

N.S.192 R.L.Coll.1356·38 R.L.Btm.1152·96

N.S.193 R.L.Coll.1355·86 R.L.Btm.1071·03

P.D.No.2

N.S.191 R.L.Coll.1356·95 R.L.Btm.1054·12

N.S.190

Sandstone & Ironstone Boulders

Washout

Old workings

Exposed section of washout in mine workings

Limit ? of

Probable

SUGARLOAF No.3

1420 1410 1400 1390 1380 1370 1360 1350

6000 S 10000 S 12000 S 14000 S 16000 S

4000W 2000W 8000W 6000W

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

SUGARLOAF MINE AREA A
DARLING DOWNS (OAKEY) COALFIELD

Showing Surface Geology, Boreholes, Mine Workings, Topography & Boundaries of Measured Reserves

To accompany report by D.C.Mengel B.Sc. Geologist

Topographic Survey by E.Cowley

Scale of Chains

5 0 5 10 15 20

Twenty Chain Grid on True North. Point of Origin, N.W. Corner Sub66A Por747 Parish of Watts

Elevations in feet on State Datum

LEGEND

Geological boundary — position approximate
Probable or indefinite boundary
Underground fault — position accurate
" " approximate
" " indefinite
Surface outcrop
Probable limit of washout
Surface contours
Colliery (working)
" (abandoned)
Seam section measured
Adit
Shaft
Diamond drillhole
Percussion "
Section line
Limit of mine workings :— Sugarloaf working seam
Boundaries of measured reserves :—
Sugarloaf working seam
Sabine top seam
Sabine btm. seam

SUGARLOAF
SUGARLOAF A
N.S.00
P.D.No.1

N.J.H.

FIG.2

DEPARTMENT OF MINES, QUEENSLAND
PLAN OF
SUGARLOAF MINE AREA B
DARLING DOWNS (OAKEY) COALFIELD
Showing Boreholes, Mine Workings & Topography
To accompany report by D.C.Mengel B.Sc. Geologist
Topographic Survey by E.Cowley
Scale of Chains
5 0 5 10 15 20
N.J.Hunt

LOCALITY MAP
SCALE OF CHAINS
50 0 50 100

3875 3526 798 1038 3679 3525 Point of Origin 747 ACLAND 3058 2740 2768 3642 3272 3422 3975 799 Parish of Watts 901 OAKEY–COOYAR 3421 3424 C.M.L. 3852 3655 801 BRANCH RAILWAY C.M.L. 114 81 3851 3768 C.M.L. 125 C.M.L. 113 296 1062 3848 51 28 C.P.A. 29 3315 2634 38 2517 SABINE

16000 S
18000 S
20000 S
4000 E
6000 E
8000 E
O.P.D. (No 5 Bore)
◎N.S.169
O.P.D. (Kerr's No.2)
◎N.S.4
R.L.Coll. 1375·90
R.L.Btm. 1144·90
◎N.S.1
R.L.Coll. 1389·32
R.L.Btm. 1168·16
◎N.S.2
R.L Coll. 1398·25
R.L.Btm. 1152·59
◎N.S.3
R.L.Coll. 1404·74
R.L.Btm. 1140·41
◎N.S.174
R.L.Coll. 1404·95
R.L.Btm. 1110·20
◎N.S.173
R.L.Coll. 1390·43
R.L.Btm. 1118·35
◎N.S.171
R.L.Coll. 1380·19
R.L.Btm. 1134·61
◎N.S.145
R.L.Coll. 1385·80
R.L.Btm. 1115·05
◎N.S.168
R.L.Coll. 1414·09
R.L.Btm. 1136·92
◎N.S.147
R.L.Coll. 1402·80
R.L.Btm. 1143·13
◎N.S.144
R.L.Coll. 1423·57
R.L.Btm. 1152·57
◎N.S.167
R.L.Coll. 1434·64
R.L.Btm. 1156·47
◎N.S.166
R.L.Coll. 1429·16
R.L.Btm. 1173·33
◎N.S.143
R.L.Coll. 1431·98
R.L.Btm. 1161·23
O.P.D. (No 1 Bore)
O.P.D. (No 2 Bore)
O.P.D. (No 3 Bore)
O.P.D. (No 4 Bore)
1380 1390 1400 1410 1420 1430
COOYAR BRANCH RLY.
801
28

Average thickness of workable coal was 4 ft. 0 in. consisting of approximately 2 ft. "middle coal" and 2 ft. "bottom coal." Generally, the "top coal" was of inferior quality.

The Sugarloaf working seam was unworkable in three boreholes drilled near the eastern boundary of C.M.L. 125 where the coal thins and deteriorates in quality to carbonaceous shale.

Three boreholes were drilled along the southern boundary of C.M.L. 113. In only one, N.S. 174, which is 16 chains south-west of N.S. 3, was the Sugarloaf working seam of workable quality. Here the combined thickness of the "middle" and "bottom coals" was approximately 4 ft.

(b) Sabine top seam

This seam is best developed in the area to the north of Sabine Siding (C.P.A. 29). In this locality it is separated from the Sugarloaf working seam by a shale band which ranges in thickness from 6 in. (N.S. 176) to 3 ft. 5 in. (N.S. 145).

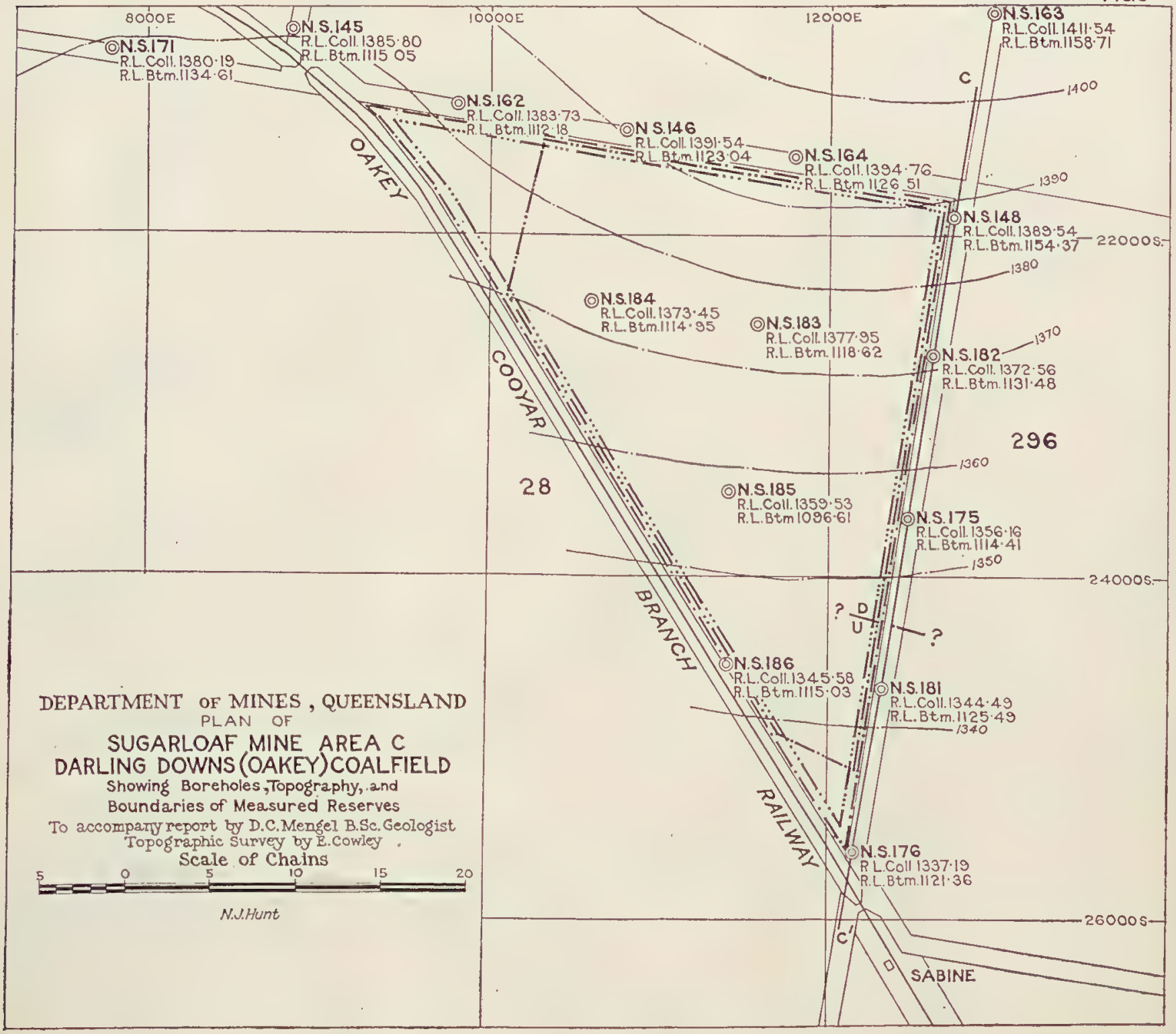
The seam averages 3 ft. 7 in. in thickness and includes at least three shale bands which are usually light coloured. In some boreholes (e.g. N.S. 176) the seam is unworkable, owing to an increase in thickness and the number of shale bands.

Six boreholes in C.M.L.s 113 to 125 also penetrated the Sabine top seam. In these the seam was less than 3 ft. thick and much of the coal was of poor quality.

(c) Sabine bottom seam

In the area to the north of Sabine Siding (C.P.A. 29) this seam is separated from the Sabine top seam by an interval ranging from 1 ft. 0¾ in. (N.S. 184) to 4 ft. 10 in. (N.S. 176) and consisting of shale or shale and fine sandstone.

FIG.3



DEPARTMENT OF MINES, QUEENSLAND
PLAN OF
SUGARLOAF MINE AREA C
DARLING DOWNS (OAKEY) COALFIELD
Showing Boreholes, Topography, and
Boundaries of Measured Reserves
To accompany report by D.C. Mengel B.Sc. Geologist
Topographic Survey by E. Cowley
Scale of Chains

5 0 5 10 15 20

N.J. Hunt

FIG. 4

SUGARLOAF MINE AREA — CROSS SECTIONS

SCALE

HORIZ. 5 0 10 15 CHAINS

VERT. 330 0 660 990 FEET

N.J.H.

A

A'

N.S.58 N.S.57 N.S.54 N.S.197 N.S.194 N.S.193 N.S.192 N.S.181

Sugarloaf Seam Working

1000' above State Datum

B

B'

N.S.53 N.S.50 N.S.47 N.S.121 N.S.46 N.S.123

Sugarloaf Seam Working

1000' above State Datum

C

C'

N.S.148 N.S.192 N.S.175 N.S.181 N.S.176

Sugarloaf Sabine Seam Working Btm. Seam

1000' above State Datum.

LEGEND

Coal

Coal with sh. bands

Sh. with coal bands

Alluvium

Shale

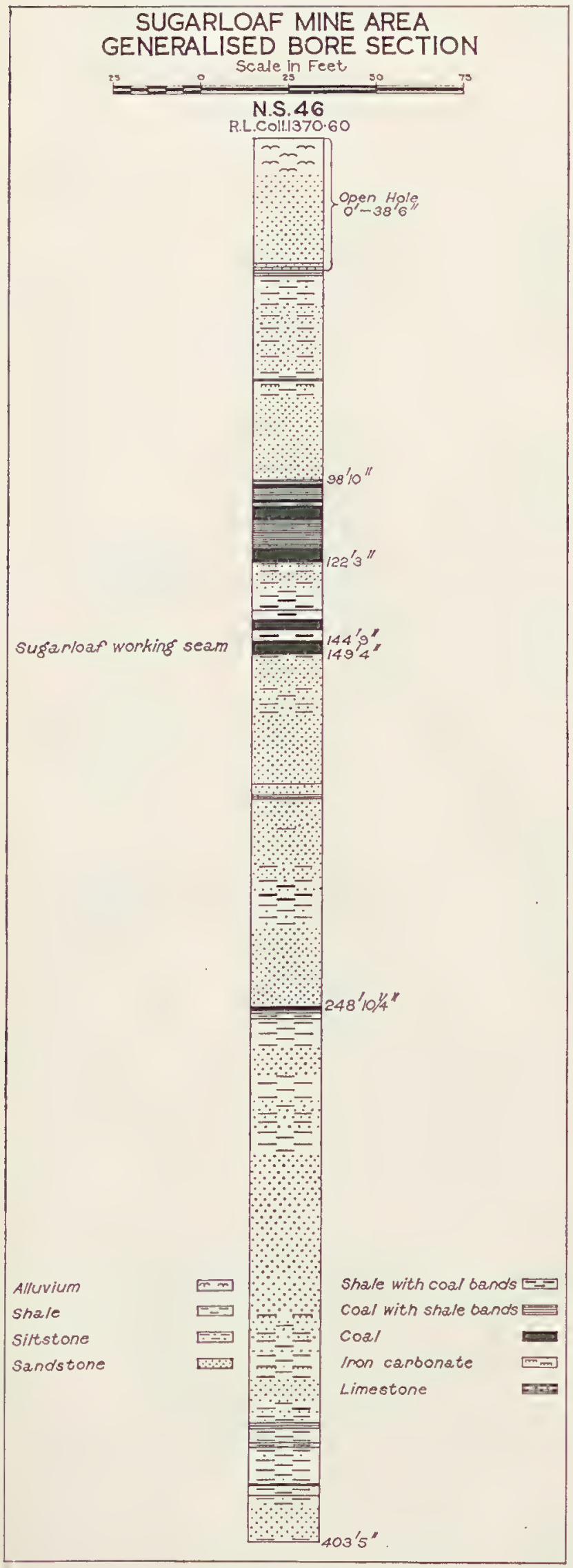
Siltstone

Sandstone

Conglomerate

Assumed limit of Washout

FIG.5



This seam, previously unknown but shown by drilling to contain substantial reserves, is described in detail. In this area it is divided into three coal sections by two persistent shale bands. The following table shows the thickness of the various units of the seam in the boreholes.

Bore No.	Coal Section A		Band X		Coal Section B		Band Y		Coal Section C	
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.
145	3	1¼	0	3	4	7¼	*1	9½	1	4
146	2	10	0	3¾	5	8¼	*0	9¾	1	6¾
148	2	11¾	0	5¼	4	2¼	0	3	1	7
162	2	7	0	3½	5	11¼	*0	7½	1	10½
164	2	6¾	0	2½	5	4	0	2½	1	6½
175	3	6½	0	3¼	5	8¼	0	1½	1	6½
176	2	7¾	0	2	4	7¼	0	2	1	3¼
181	3	1½	0	5½	5	0¼	0	3	1	11¼
182	3	6½	0	2½	3	9¾	0	2½	1	7
183	3	9½	0	2	4	4	0	2½	1	7¼
184	3	7	0	2¾	5	3½	0	1¾	1	6½
185	4	1¼	0	2¼	5	0	0	0¾	1	10¼
186	3	5½	0	3	4	3¼	0	2¼	1	6

* Double band.

NB. The thickness of the coal sections in this table are not necessarily the same as sections analysed.

Coal section A is a banded section which ranges in thickness from 2 ft. 6¾ in. (N.S. 164) to 4 ft. 1¼ in. (N.S. 185). It consists of thick coal bands with interbedded carbonaceous and light coloured shale. Most of this section is of workable quality except in the northern part of C.P.A. 29.

Band X is most persistent and consists of a few inches of fawn shale.

Coal section B ranges in thickness from 3 ft. 9¾ in. (N.S. 182) to 5 ft. 11¼ in. (N.S. 162). It usually contains carbonaceous and light coloured shale bands. The most persistent of these is a light grey shale band 1-4 in. thick near the middle of the section.

Band Y consists of a few inches of light coloured shale which increases greatly in thickness in the north-western corner of C.P.A. 29. In N.S. 145 the band is 1 ft. 9½ in. thick and consists of fine sandstone and shale.

Coal section C contains a few shale bands and averages 1 ft. 7 in. in thickness.

It appears that the Sabine bottom seam reaches optimum workability in C.P.A. 29. Where tested elsewhere there is an increase in thickness of included shale bands.

The seam was penetrated in three boreholes drilled in C.M.L. 125. Coal section C is present in these boreholes but, because of the thickness of bank Y, it is of no importance in the area. In the most northerly borehole, N.S. 166, coal sections A and B constitute a working thickness. In N.S. 167, coal section B is of good quality but coal section A is banded. In the most southerly borehole N.S. 168, coal section A and the upper 2 ft. 6 in. of coal section B are inferior in quality and banded.

Band Y increases in thickness to the north and is 6 ft. 4 in. thick in N.S. 167.

The seam was also tested in three boreholes drilled along the southern boundary of C.M.L. 113. Coal sections A and B are workable in N.S. 171 and 173 (see detailed seam sections). Coal section A is banded and unworkable in N.S. 174. Band Y is of greater thickness than in C.P.A. 29 and is 3 ft. 0 in. thick in N.S. 171. Coal section C is present in N.S. 171 and 174 but was not reached in N.S. 173.

(iii) The Washout

Mine workings of the present colliery terminate on the west against a washout which has penetrated the coal measures, at least to the depth of the worked coal section and replaced them with heterogeneous material. This is made up of angular and sub-angular fragments of Tertiary basalt and Jurassic sandstone, siltstone, shale and unweathered coal, loosely packed in a clayey matrix containing rounded quartz grains and lithic fragments. The washout material is poorly sorted and ranges in size from grit to large boulders.

This material appears to have been transported only a short disance by a swiftly flowing current of short duration. The course of the stream is not known outside the mine area but it is suggested that the source was to the south.

Departmental diamond drilling and percussion drilling by the company in portions 3424, 3655, and 3768, parish of Watts have indicated the limits of the washout in the mine area (see figure 1). In portion 3,768 borehole N.S. 191 (redrill of N.S. 190) penetrated the floor of the washout at approximately 140 ft.

Several excellent exposures of the junction between the Sugarloaf working seam and the washout were examined in the mine workings. This junction is well defined and there is no marginal disturbance of the coal section. Generally the slope of the bank of the washout is steep and ranges from 45 to 60 degrees. However, in recent mine workings in the north-west, the slope is as low as 20 degrees.

The age of the washout is indeterminate. It could have occurred at any stage after the beginning of Tertiary volcanic activity.

STRUCTURAL GEOLOGY

The beds of the coal measures are very flat lying. The regional dip (less than 5 degrees) is in a southerly direction but many local irregularities occur in both grade and direction of dip.

Only minor faulting has been encountered in the mine workings. These minor faults tend to follow the two general directions of faulting evident in the Acland Mine Area i.e. N.E.–S.W. and N.W.–S.E. It is highly probable that any other faulting in this mine area will reflect this general pattern.

A major fault trending N.W.–S.E. was proved by drilling in portions 3852 and 3768, parish of Watts (see figure 4). This fault has a downthrow of approximately 100 ft. to the south-west.

In the area north-west of the present workings, a difference in levels of 83 ft. on the floor of the Sugarloaf working seam in adjacent boreholes N.S. 55 and 125, indicates considerable dislocation of the seam. Insufficient information is available to give a completely satisfactory explanation of the structure here. It may be explained by a normal fault between N.S. 55 and N.S. 125 striking N.E.–S.W. and with a downthrow of approximately 40 ft. to the south-east. Core from N.S. 55 shows abnormally steep dips (13 to 17 degrees) in strata above the worked coal section. This indicates a normal fault close to N.S. 55 as nearby boreholes show no evidence of faulting.

A fault, with a downthrow of approximately 25 ft. in a northerly direction, is indicated between N.S. 175 and N.S. 181 near Sabine Siding but the strike and type of fault are not known.

NATURE OF COAL

The coal from all sections analysed is of high volatile A to B bituminous rank (A.S.T.M. classification). Fixed carbon calculated on a dry, mineral-matter-free basis ranges from 45·1 to 54·5 per cent. Calorific values calculated on a moist, mineral-matter-free basis range from 12,320 to 14,730 B.T.U.'s per lb. Coking properties are weak to negligible.

COAL RESOURCES

Only measured coal reserves have been calculated in the Sugarloaf Mine Area. To be included in this category, a coal section must satisfy the following arbitrary conditions:—

(i) A minimum thickness of 3 ft.

(ii) An ash content, after the removal of bands normally removed in mining, of not more than 25 per cent.

(iii) A depth below the surface of at least 50 ft.

The area of measured reserves has been defined as extending no more than 5 chains beyond a peripheral point of observation (e.g. borehole, perimeter of mine workings). Points of observation should not be more than 12½ chains apart.

The unavailability of coal due to faulting has been disregarded and no allowance has been made for loss of coal in mining.

In the Sugarloaf Mine Area coal reserves have been measured in the following seams:

(i) Sugarloaf working seam

In C.M.L. 81 measured reserves in this seam exist in an area of 242 acres. The average workable thickness of the seam is 4 ft. 10¾ in. and the average weighted specific gravity is 1·37. Reserves have been calculated at 1,970,000 tons.

Reserves of 150,000 tons of coal, proved by the earlier emergency drilling programme, have not been included in this figure.

The area of measured reserves has not been extended to include bores N.S. 57 and 58 because of excessive distance between these bores and bores with workable coal sections to the east, and also because of high average weighted ash contents of the coal sections analysed. However, some reserves are indicated in the vicinity of these boreholes.

Borehole N.S. 122 was included in the area of reserves even though the average weighted ash content is slightly in excess of 25 per cent. By excluding shale bands which were included in the original samples the ash content could be reduced to below the arbitrary maximum figure.

In C.P.A. 29, there are measured reserves of 450,000 tons in this seam, which has an average workable thickness of 4 ft. 0 in., over an area of 67 acres.

Borehole N.S. 181 was included in the area of reserves even though its average weighted ash content was in excess of 25 per cent. This ash content could be reduced below the allowable limit by the exclusion of a carbonaceous shale band near the base of the bottom coal.

(ii) Sabine top seam

Reserves of 320,000 tons in this seam, which has not yet been worked, extend over an area of 60 acres in C.P.A. 29. The average workable thickness is 3 ft. 2½ in.

(iii) Sabine bottom seam

Coal reserves in this unworked seam have been calculated for two areas in C.P.A. 29:—

(*a*) An area of 16·5 acres, 5 chains wide, extending to the northern boundary.

In this area, the top coal section above the uppermost persistent band is unworkable. The average thickness of workable coal is 6 ft. 6 in. in a coal section which ranges up to 8 ft. Reserves of 180,000 tons have been calculated.

(*b*) An area of 50·5 acres to the south of the above.

In this part of C.P.A. 29 the section of coal above the uppermost persistent shale band is workable. The average thickness of workable coal is 8 ft. 4½ in. in a seam section which averages approximately 10 ft. Reserves of 710,000 tons have been calculated.

Total reserves in the Sabine bottom seam in C.P.A. 29 amount to 890,000 tons.

CONCLUSION

Diamond drilling in the Sugarloaf Mine Area has established the following measured reserves:—

	Seam	Tonnage
C.M.L. 81	Sugarloaf working seam (emergency drilling programme)	150,000
C.M.L. 81	Sugarloaf working seam	1,970,000
C.P.A. 29	Sugarloaf working seam	450,000
C.P.A. 29	Sabine top seam	320,000
C.P.A. 29	Sabine bottom seam	890,000
	Total	3,780,000

The limits of reserves in the three seams tested in C.P.A. 29 have not been reached. Further exploration to the east, south, and west of the area drilled could be expected to extend these reserves. The Sabine bottom seam offers the best prospects.

REFERENCES

BALL, L. C., 1916: Oil shales and coal, Sugarloaf. *Qld Govt Min. J., 17,* 165-167.

CUTHBERT, J. O., (1950): Report on further developments regarding the washout encountered during mining operations. Unpub. rep. Geol. Surv. Qld.

HAWTHORNE, W. L., 1960: Coal resources, Darling Downs, Sugarloaf mine area, Oakey. *Qld Govt Min. J., 61,* 358-362.

MENGEL, D. C., 1963: Coal resources, Darling Downs (Oakey) coalfield, Acland mine area. *Geol. Surv. Qld Publ.,* 314, 6-25.

6th March, 1961

APPENDIX

FOSSIL PLANTS FROM THE SUGARLOAF MINE AREA

By N. J. DE JERSEY, Ph.D., M.Sc.

The fossil plants described in this report were collected by Mr. D. C. Mengel, Geologist, Geological Survey of Queensland, from the core of Bore N.S. 194, in the Sugarloaf Mine Area (Oakey coalfield). This bore is located in portion 3655, parish of Watts, county of Aubigny. The fossils are preserved as impressions in shale and came from depths of approximately 35 ft. and 37 ft. They are determined as follows:—

Coniopteris delicatula?

Equisetites sp.

The specimens examined exhibit the following features:—

(1) *Coniopteris delicatula?*

This is represented by one specimen from approximately 35 ft. in Bore N.S. 194. This consists of a fragment of a sterile frond characterised by pinnae deeply dissected into linear segments. The venation is indistinct but there appears to be one median vein to each ultimate segment. Specific determination is

difficult as this specimen is part of a sterile frond and considerable importance is attached to characters of the fertile fronds in distinguishing the species of *Coniopteris*. The specimen closely resembles *C. delicatula* described by Walkom from Shorncliffe (1917, pp. 6, 7) in the deep dissection of the lamina. However another common species *C. hymenophylloides* exhibits a wide range of variation in the appearance of the steril fronds (as illustrated by Jacob and Shukla 1955, Plates IV and V), and while the more normal types are broad and roundly lobed, some of the extreme types are as deeply dissected as the Sugarloaf specimen. Consequently the specimen is only doubtfully referred to *C. delicatula.*

(2) *Equisetites sp.*

This is represented by three specimens of nodal diaphragms from approximately 37 ft. in Bore N.S. 194. They are about 10-11 mm. in diameter with a central area 3 mm. in diameter and segments corresponding to the free teeth at the node, 24 in number in the only complete specimen. At least three of the smaller species of *Equisetites—E. rotiferum, E. ferganensis* and *E. columnaris*—have nodal diaphragms similar to these specimens, the distinction between these species being based on the characters of the leaf sheaths, which are not available in the present collection. Consequently the specimens are determined generically only. They are, however, distinct from nodal diaphragms of the larger species, such as *E. Woodsi* and *E. contectum* (recorded from the Brighton Beds).

This small collection is of interest as plant fossils are not abundant in the cores recovered in the drilling programme in this coalfield. While the specimens do not permit any precise age determination, the presence of *Coniopteris* and *Equisetites,* two genera which are common in Jurassic floras, is in agreement with the generally accepted Jurassic age of the coal measures in the Oakey district.

REFERENCES

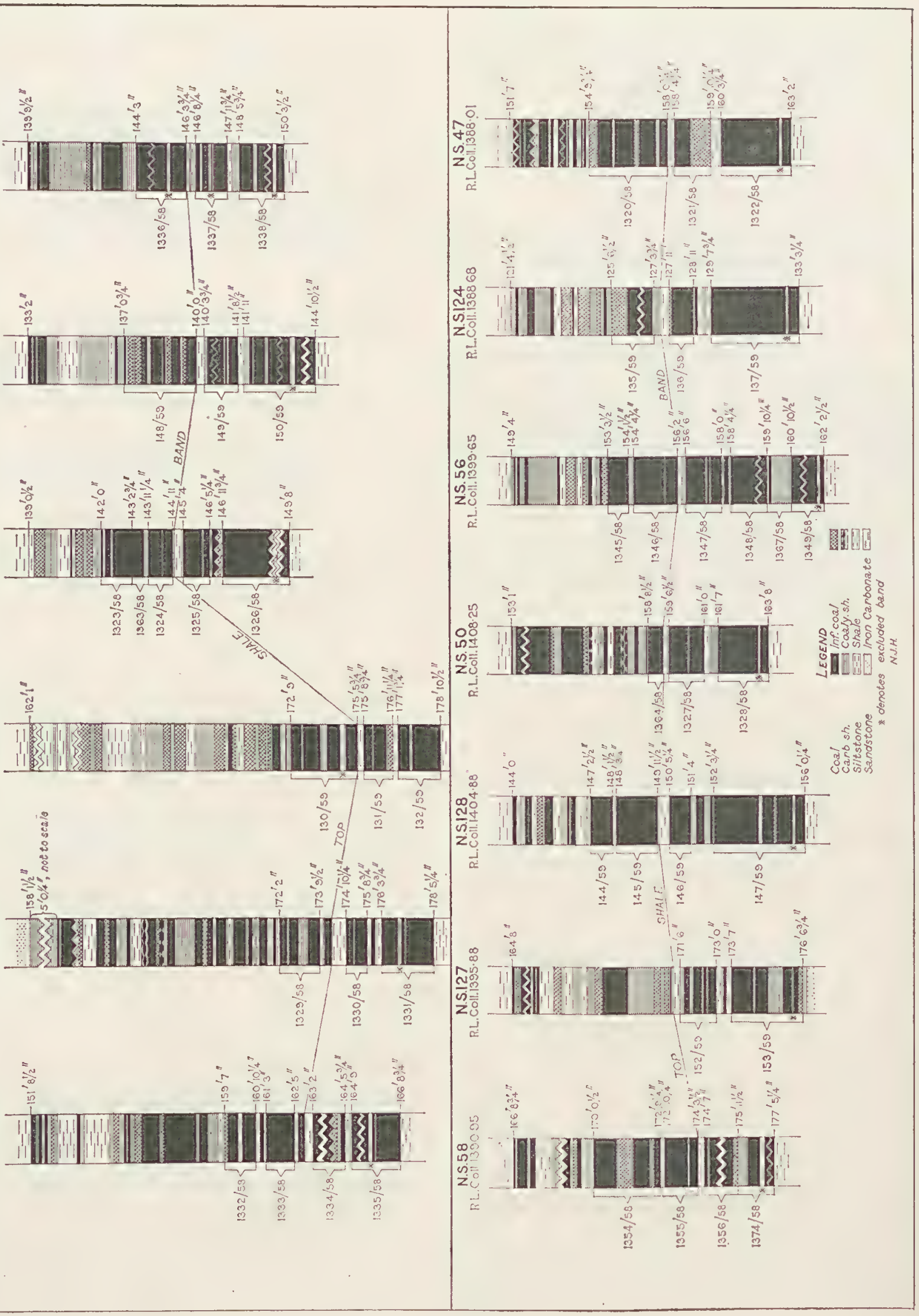
JACOB, K., and SHUKLA, B. N., 1955: Jurassic plants from the Saighan Series of Northern Afghanistan and their palaeo-climatological and palaeo-geographical significance. *Man. Geol. Surv. India* (*Pal.Indica*) (*N.S.*) 33, *Mem.* 2.

WALKOM, A. B. 1915: Mesozoic flora of Queensland. Part 1. The flora of the Ipswich and Walloon Series (*a*) Introduction (*b*) Equisetales. *Geol. Surv. Qld Publ.,* 252.

————, 1917: Mesozoic flora of Queensland. Part 1.—continued. The flora of the Ipswich and Walloon Series (*c*) Filicales, etc. *Geol. Surv. Qld Publ.,* 257.

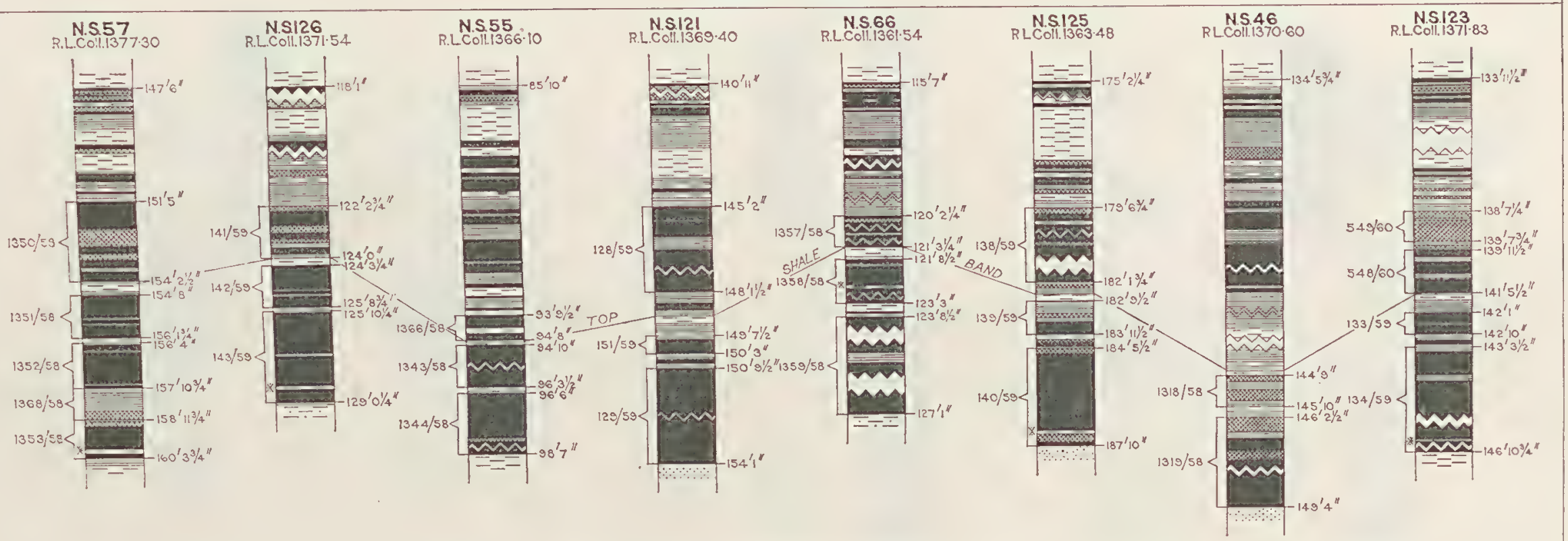
FIG.6

SUGARLOAF MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM



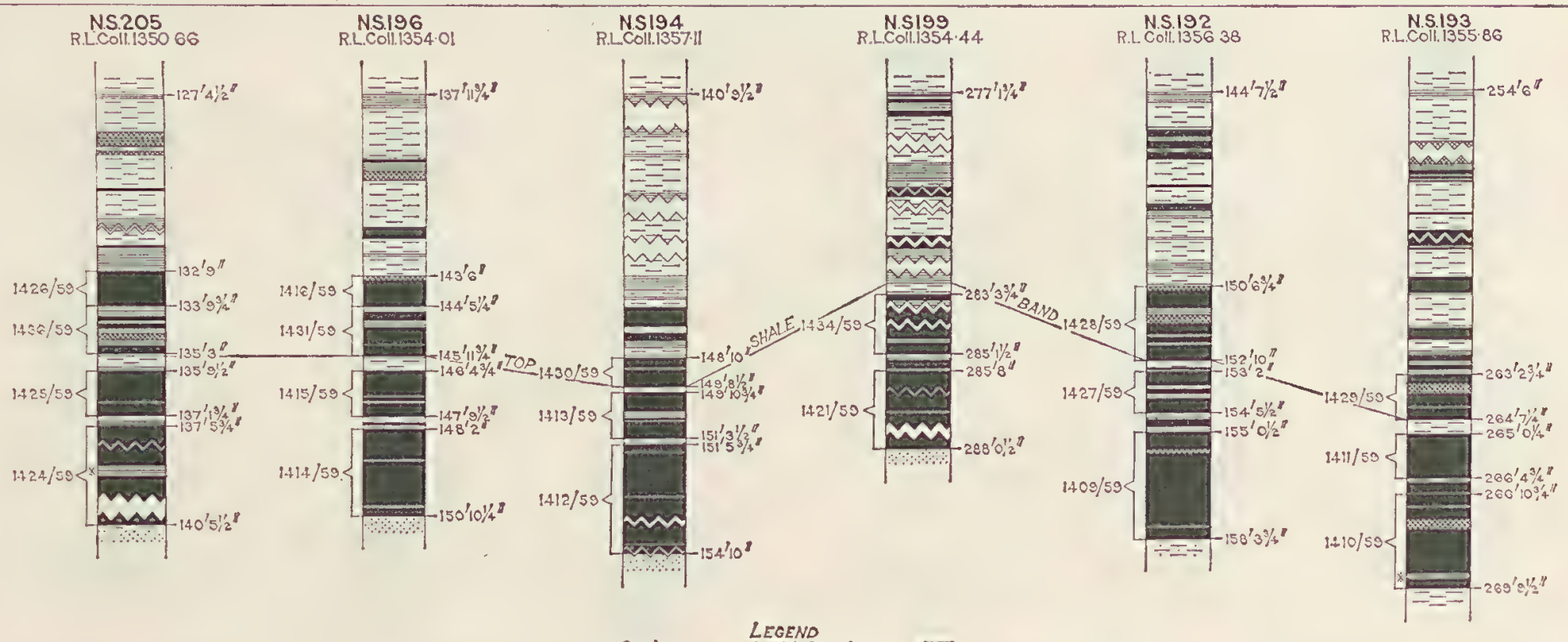
SUGARLOAF MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

FIG. 7



SUGARLOAF MINE AREA—DETAILED SEAM SECTIONS
WORKING SEAM

FIG. 8



SUGARLOAF No.3 COLLIERY SECTIONS

	A	Description		B	Description	Prox. Analysis S, Cal. Val. & S.C.	Section Sampled	C	Description
Section not sampled		8'5" 1'2" coal 1½" gy.sh. 1'0" coal ½" gy.sh. 6" coal ½" sh. & coal 3½" gy.sh. 2" inf. coal 6½" coal 1" sh. 2½" coal 1" shaly coal 2" coal 3" l.gy.sh. 1½" sh. & coal 2" coal 1½" dk. & l.gy.sh. 1'0" coal ½" floating band. 1'11" coal 2" wh.sh. 2½" coal	Section not sampled		6'10½" 4" wh.sh. 2" coal & sh. 11" coal ½" gy.sh. 1½" coal ½" gy.sh. 6" coal 2" wh.sh. 2½" coal & sh. 5" coal ½" sh. 3'4" coal 1' gy.sh. 6" coal	M.% V.M.% F.C.% A% S% B.T.U./lb. Joules/gm. S.G.	142/60	6'11¼"	1'8" coal 3" f.wn.sh. 4½" v.inf.coal→ carb.sh. 9" coal→inf. coal in places 1¾" f.wn.sh. 3¾" coal ¾" f.wn.sh. 2" coal 4½" carb.sh. 8" coal—some inf. 3" carb.sh→inf. coal in places 1'11" coal with ½" f.wn.sh 2½" from btm.

N.J.H.

FIG. 9

SUGARLOAF MINE AREA—DETAILED SEAM SECTIONS

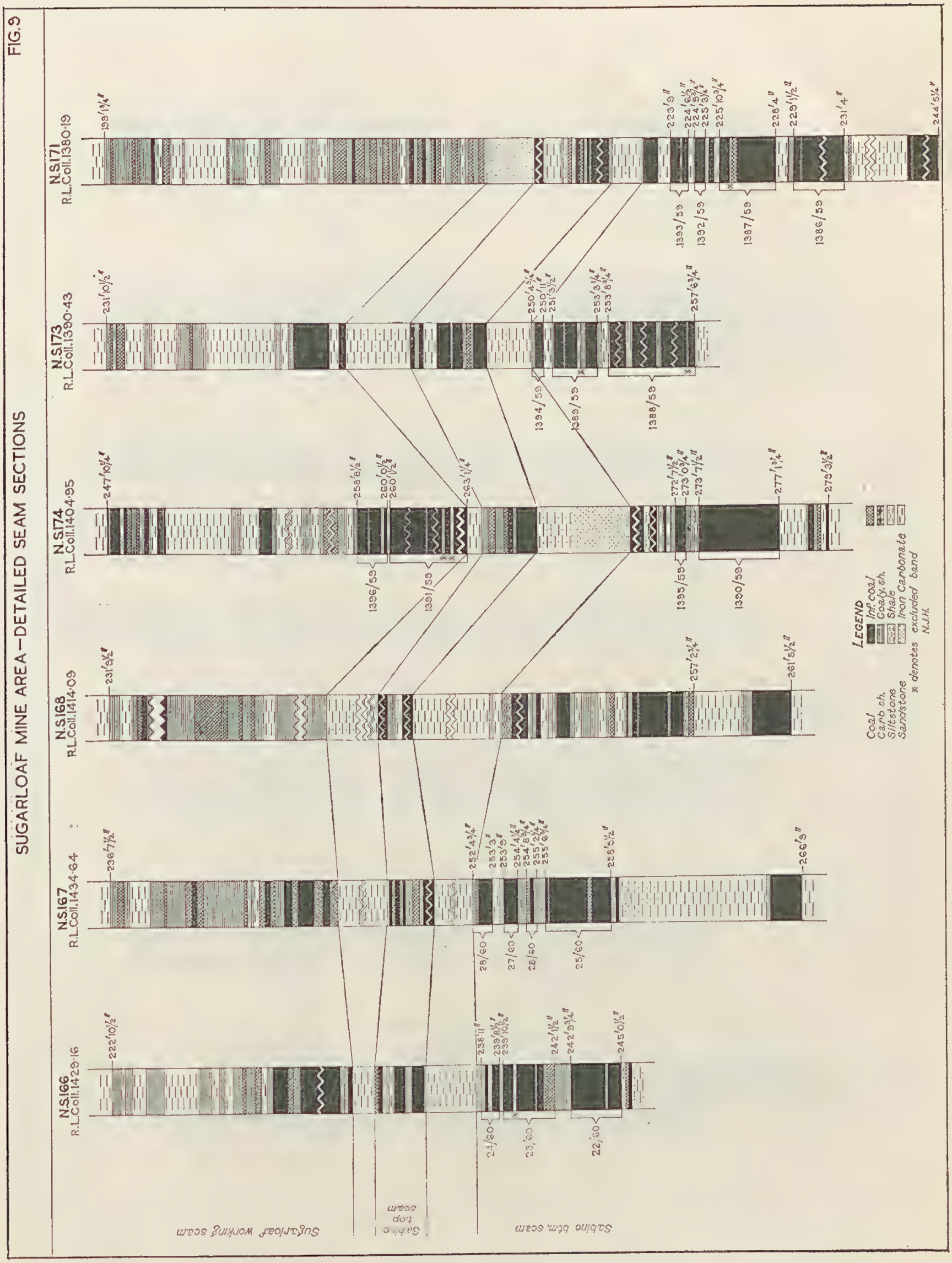


FIG. 10

SUGARLOAF MINE AREA (C.P.A. 29)–DETAILED SEAM SECTIONS

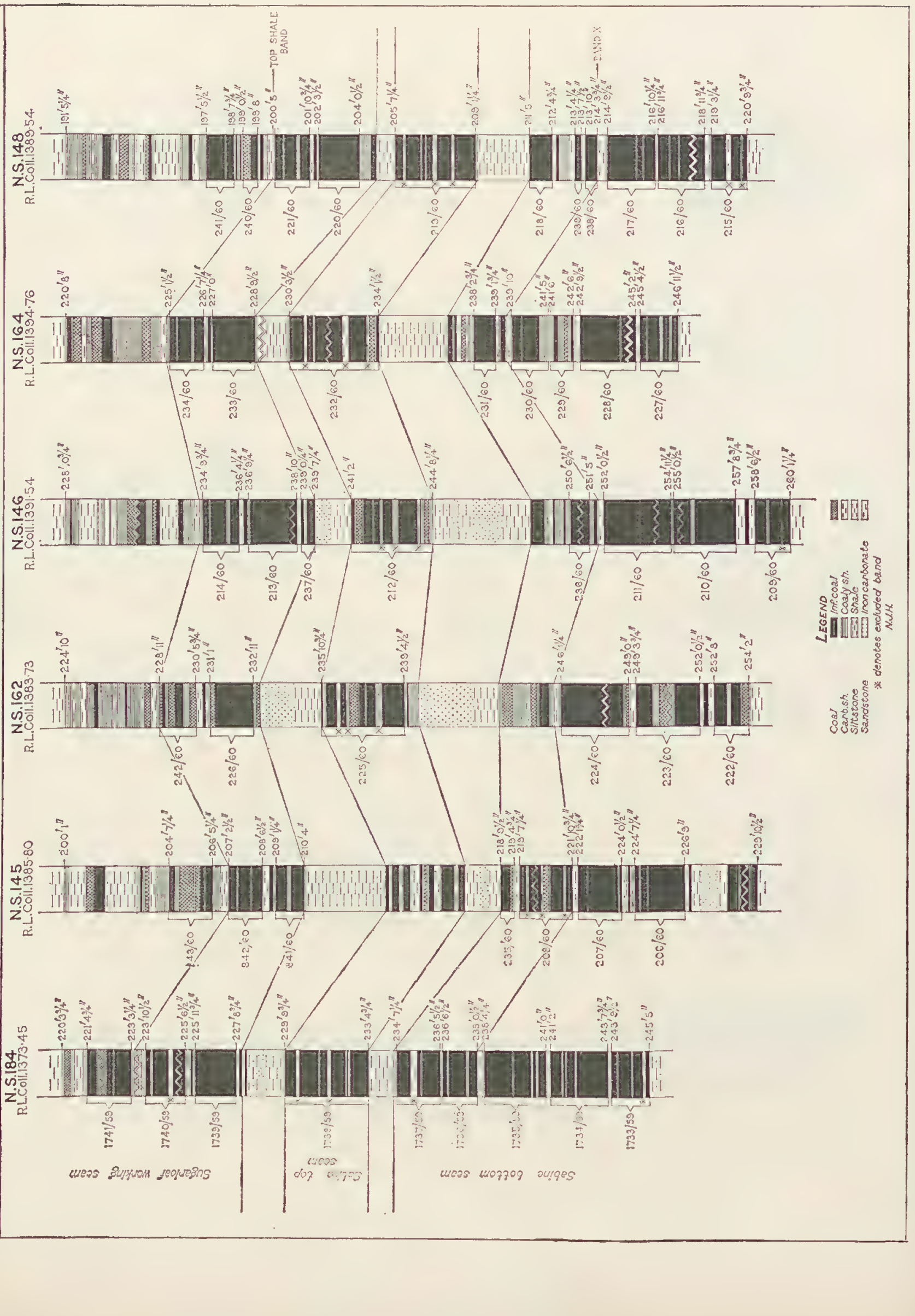
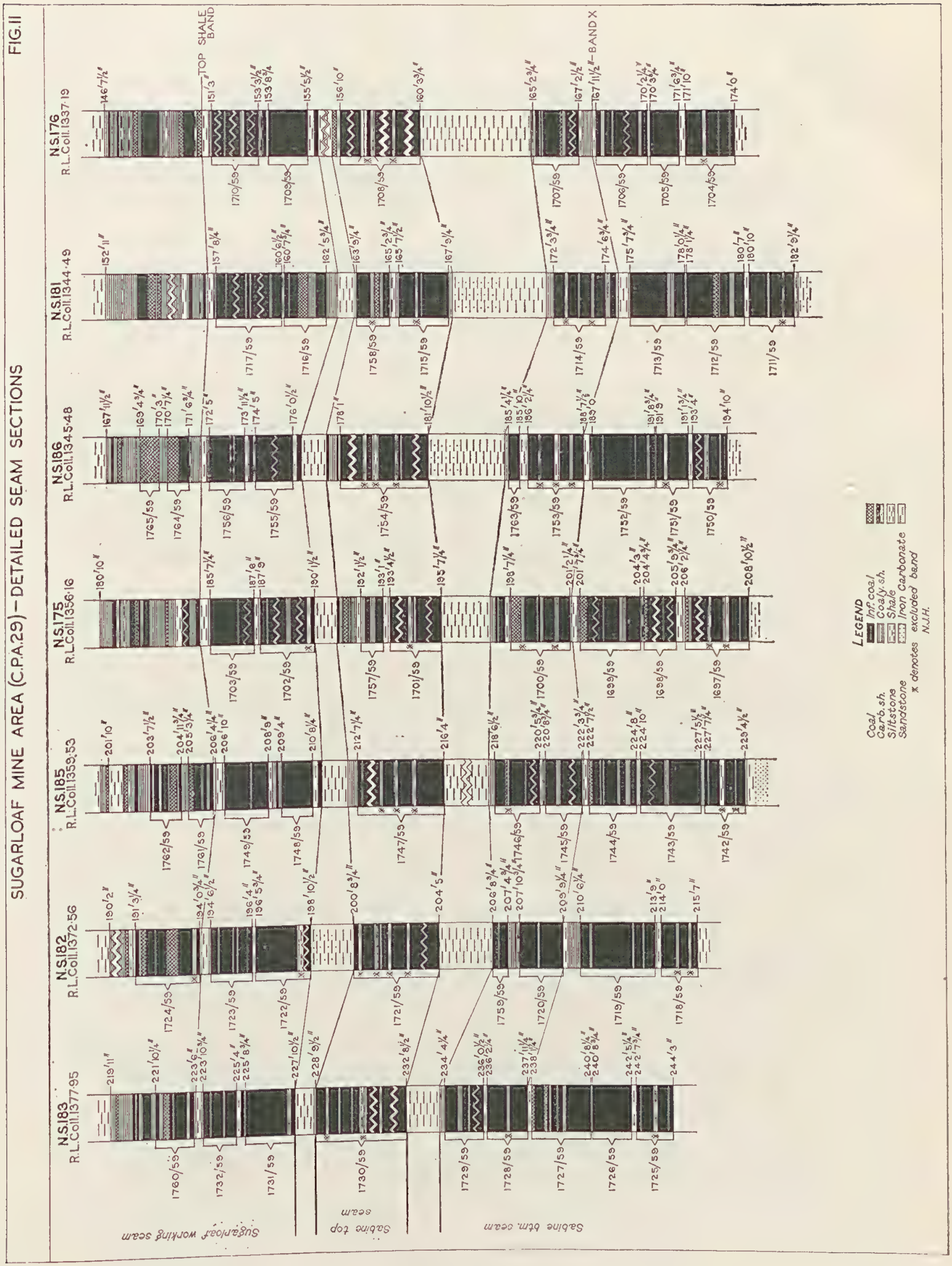


FIG. 11

SUGARLOAF MINE AREA (C.P.A.29)—DETAILED SEAM SECTIONS



B

TABLE OF RECOVERIES AND ANALYSES

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
46	Sugarloaf working seam	144 9 —145 10	1 1	100	1318/58	5·8	26·5	15·6	52·1	..	0·56	5750	1·706	..
		146 2½—149 4	3 1½	94·5	1319/58	5·1	32·1	26·7	36·1	..	0·64	8270	1·652	..
47	Sugarloaf working seam	154 9¾—158 0¾	3 3	100	1320/58	5·7	35·1	32·2	27·0	23·03	0·41	9490	1·545	..
		158 4¼—159 10¼	1 6	100	1321/58	4·5	36·5	31·0	28·0		0·48	9490	1·450	..
		160 3¼—163 2	2 10¾	100	1322/58	4·8	40·7	38·5	16·0		0·43	11620	1·352	..
49	Sugarloaf working seam	142 0 —143 2¾	1 2¾	100	1323/58	5·6	37·6	37·8	19·0	..	0·49	10890	1·381	..
		143 2¾—143 11¼	0 8½	100	1363/58	..	..	..	28·6	..	..	..	..	..
		143 11¼—144 11	0 11¾	100	1324/58	4·3	36·7	29·8	29·2	..	0·40	9530	1·559	..
		145 4 —146 5¼	1 1¼	100	1325/58	4·2	38·6	34·0	23·2	19·72	0·40	10520	1·398	..
		146 11¾—149 8	2 8¼	87·5	1326/58	3·9	40·7	37·1	18·3		0·40	11420	1·366	..
50	Sugarloaf working seam	158 8½—159 6½	0 10	100	1364/58	..	..	..	36·4	..	..	..	..	..
		159 6½—161 0	1 5½	100	1327/58	4·6	38·1	35·0	22·3	18·01	0·54	10620	1·399	..
		161 7 —163 8	2 1	100	1328/58	4·4	40·9	39·7	15·0		0·51	11730	1·426	..
51	Sugarloaf working seam	172 2 —173 9½	1 7½	100	1329/58	4·7	36·5	32·7	26·1	19·92	0·42	9890	1·527	..
		174 10¼—175 8¾	0 10½	100	1330/58	4·1	39·1	35·4	21·4		0·53	10760	1·390	..
		176 3¾—178 5¼	2 1½	100	1331/58	5·5	39·1	40·8	14·6		0·43	11570	1·350	..
52	Sugarloaf working seam	159 7 —160 10¼	1 3¼	100	1332/58	4·1	36·0	29·5	30·4	..	0·43	9450	1·471	..
		161 3 —162 5	1 2	100	1333/58	3·8	38·3	29·7	28·2	21·50	0·54	9880	1·529	..
		163 2 —164 5¾	1 3¾	73	1334/58	4·5	36·7	31·8	27·0		0·58	9680	1·543	..
		164 9 —166 8¾	1 11¾	91·5	1335/58	5·4.	39·4	41·3	13·9		0·52	11590	1·338	..
53	Sugarloaf working seam	144 3 —146 3¾	2 0¾	96	1336/58	4·4	39·4	35·7	20·5	18·01	0·51	10930	1·375	..
		146 8¼—147 11¾	1 3½	100	1337/58	4·0	39·6	37·7	18·7		0·51	10670	1·390	..
		148 5¾—150 3½	1 9¾	91	1338/58	5·5	38·9	40·9	14·7		0·48	11190	1·460	..
54	Sugarloaf working seam	132 3 —134 4½	2 1½	98	1339/58	5·3	37·0	32·3	25·4	20·13	0·43	9900	1·512	..
		134 8½—136 4¼	1 7¾	98·5	1340/58	5·1	38·2	35·0	21·7		0·43	10510	1·393	..
		136 5¾—138 1	1 7¼	97·5	1341/58	5·8	38·5	39·3	16·4		0·41	11260	1·353	..
		138 1 —138 8	0 7	100	1365/58	..	..	..	57·8 exel.		..	..	..	..
		138 8 —140 0	1 4	87·5	1342/58	5·6	40·4	39·9	14·1		0·48	11640	1·331	..
55	Sugarloaf working seam	93 9½— 94 8	0 10½	100	1366/58	..	..	..	20·5	16·99	..	..	..	..
		94 10 — 96 3½	1 5½	94·5	1343/58	6·0	40·1	36·1	17·8		0·50	10890	1·366	..
		96 6 — 98 7	2 1	96	1344/58	4·2	43·3	37·8	14·7		0·41	11760	1·329	..
56	Sugarloaf working seam	153 3½—154 4¼	1 0¾	100	1345/58	5·6	34·5	29·7	30·2	..	0·48	1990	1·470	..
		154 4¼—156 2	1 9¾	100	1346/58	4·3	38·0	31·9	25·8	22·83	0·46	10140	1·505	..
		156 6 —158 .0	1 6	100	1347/58	4·6	36·1	33·2	26·1		0·37	9240	1·519	..
		158 4½—159 10¼	1 5¾	91·5	1348/58	4·5	40·1	39·5	15·9		0·57	11810	1·333	..
		159 10¼—160 10½	1 0¼	100	1367/58	..	..	..	44·6	..	..	..	..	..
		160 10½—162 2½	1 4	100	1349/58	4·4	38·4	30·4	26·8	..	0·88	9890	1·428	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
57	Sugarloaf working seam	151 5 —154 2½	2 9½	100	1350/58	4·7	36·4	29·3	29·6	24·87	0·43	9400	1·460	..
		154 8 —156 1¾	1 5¾	100	1351/58	5·3	37·4	35·9	21·4		0·48	10560	1·486	..
		156 4 —157 10¾	1 6¾	100	1352/58	5·4	38·2	36·7	19·7		0·60	10720	1·469	..
		157 10¾—158 11¾	1 1	100	1368/58	..	..	..	60·0	..	..	..	..	..
		158 11¾—160 3¾	1 4	100	1353/58	4·5	37·8	29·1	28·6	..	0·81	9640	1·446	..
58	Sugarloaf working seam	170 0½—172 9¼	2 8¾	97	1354/58	4·6	36·8	32·2	26·4	25·63	0·47	9920	1·438	..
		172 10¼—174 3½	1 5¼	94	1355/58	4·9	35·1	22·1	27·9		0·55	9570	1·461	..
		174 7 —175 11½	1 4½	94	1356/58	4·9	37·4	36·0	21·7		0·47	10540	1·471	..
		175 11½—177 5¼	1 5¾	94·5	1374/58	..	..	..	34·9	..	..	..	..	..
66	Sugarloaf working seam	120 2¼—121 3¼	1 1	84·5	1357/58	5·0	35·3	28·3	31·4	..	0·46	9050	1·558	..
		121 8½—123 3	1 6½	94·5	1358/58	4·9	35·0	30·2	29·9	22·95	0·41	9250	1·465	..
		123 8½—127 1	3 4½	67·5	1359/58	4·4	40·0	35·0	20·6		0·45	10550	1·382	..
67	Sugarloaf working seam	152 7¼—153 5¾	0 10½	100	1369/58	..	..	..	24·0	..	..	..	..	..
		154 3¾—157 5½	3 1¾	96·5	1360/58	5·2	36·4	29·3	29·1	..	0·55	9350	1·459	..
68	Sugarloaf working seam	127 4¾—129 1¾	1 9	90·5	1361/58	4·6	36·8	31·7	26·9	24·1	0·51	9780	1·519	..
		129 2½—132 3	3 0½	94·5	1362/58	4·8	38·8	33·9	22·5		0·52	9820	1·501	..
121	Sugarloaf working seam	145 2 —148 1½	2 11½	96·5	128/59	5·0	34·3	29·4	31·3	..	0·40	9410	1·483	Af
		149 7½—150 3	0 7½	100	151/59	..	..	..	32·6	..	..	..	..	..
		150 9½—154 1	3 3½	97·5	129/59	4·1	39·8	37·3	18·8	18·8	0·42	11120	1·378	Aw/Af
122	Sugarloaf working seam	172 9 —175 5¾	2 8¾	99	130/59	4·1	36·5	34·3	25·1	25·68	0·43	10270	1·428	Af
		175 8¾—176 11¼	1 2½	100	131/59	4·1	36·0	30·6	29·3		0·46	9390	1·466	Af
		177 1¾—178 10½	1 8¾	100	132/59	5·1	35·6	35·3	24·0		0·39	9120	1·432	Af
123	Sugarloaf working seam	138 7¼—139 7¾	1 0½	100	549/60	..	..	..	28·8	..	..	..	..	..
		139 11½—141 5½	1 6	100	548/60	..	..	..	27·0	..	..	..	..	..
		142 1 —142 10	0 9	100	133/59	4·3	36·9	31·5	27·3	21·08	0·40	10000	1·441	Af
		143 3½—146 10¾	3 7¼	86·5	134/59	4·1	39·3	36·8	19·8		0·64	11000	1·376	Aw
124	Sugarloaf working seam	125 6½—127 3¾	1 9¼	90·5	135/59	5·1	37·9	36·3	20·7	18·39	0·36	10670	1·385	Af
		127 11 —128 11	1 0	100	136/59	4·5	35·5	31·6	28·4		0·34	9140	1·450	Af
		129 7¾—133 3¼	3 7½	100	137/59	4·5	41·5	39·5	14·5		0·41	11920	1·328	Aw
125	Sugarloaf working seam	179 6¾—182 1¾	2 7	76·5	138/59	4·4	37·7	34·0	23·9	..	0·42	10230	1·410	Aw
		182 9½—183 11½	1 2	100	139/59	4·8	30·2	24·2	40·8	..	0·43	7360	1·590	Nc
		184 5½—187 10	3 4½	100	140/59	3·8	41·4	38·4	16·4	16·4	0·41	11380	1·347	Aw
126	Sugarloaf working seam	122 2¾—124 0	1 9¼	100	141/59	4·3	35·9	30·9	28·9	..	0·37	9470	1·457	Af
		124 3¼—125 8¾	1 5½	100	142/59	4·2	34·7	30·8	30·3	..	0·36	9230	1·476	Af
		125 10¼—129 0¼	3 2	100	143/59	4·7	40·6	39·6	15·1	15·1	0·38	11670	1·337	Aw/Af
127	Sugarloaf working seam	171 6 —173 0	1 6	100	152/59	..	..	..	27·9	..	..	..	..	..
		173 7 —176 6¾	2 11¾	100	153/59	..	..	..	28·6	..	..	..	..	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
128	Suagrloaf working seam	147 2½—148 1½	0 11	100	144/59	4·4	38·8	36·2	20·6	19·84	0·45	10890	1·385	Af
		148 3¼—149 11½	1 8¼	100	145/59	4·1	39·0	33·2	23·7		0·37	10510	1·398	Af
		150 5¼—151 4	0 10¾	100	146/59	4·1	38·3	36·4	21·2		0·39	10870	1·381	Af
		152 3¼—156 0¼	3 9	100	147/59	4·8	38·9	38·7	17·6		0·57	11200	1·359	Aw/Af
136	Sugarloaf working seam	137 0¾—140 0	2 11¼	100	148/59	4·3	37·5	32·8	25·4	22·59	0·40	10210	1·417	Af
		140 3¾—141 8½	1 4¾	94	149/59	5·0	35·5	34·0	25·5		0·39	9950	1·432	Af
		141 11 —144 10½	2 11½	89·5	150/59	5·0	38·1	38·5	18·4		0·41	11110	1·373	Af
145	Sugarloaf working seam	204 7¼—206 5¼	1 10	100	843/60	..	..	..	33·6	..	..	..	..	..
		207 2½—208 6½	1 4	100	842/60	..	..	..	24·1	..	..	..	..	..
		209 1¼—210 4	1 2¾	100	841/60	..	..	..	20·8	..	..	..	..	..
	Sabine bottom seam	218 9½—219 4¾	0 7¼	100	235/60	..	..	..	16·9	18·96	..	..	..	..
		219 7¼—221 10¾	2 3½	96·5	208/60	4·3	38·5	33·2	24·0		0·54	10260	1·420	Af/Cw
		222 1¾—224 0½	1 10¾	100	207/60	4·9	39·5	38·3	17·3		0·67	11130	1·372	Cw
		224 7¼—226 9	2 1¾	100	206/60	4·9	39·8	38·1	17·2		0·45	11340	1·366	Cw
146	Sugarloaf working seam	234 9¾—236 4¼	1 6½	100	214/60	4·5	35·8	32·1	27·6	21·87	0·42	9660	1·456	Af
		236 9¼—238 10	2 0¾	96	213/60	4·5	41·3	36·6	17·6		0·41	11250	1·367	Af/Cw
		239 0¼—239 7¼	0 7	100	237/60	..	..	..	26·3	..	..	..	..	..
	Sabine top seam ..	241 2 —244 8¼	3 6¼	98	212/60	5·0	37·6	33·9	23·5	23·5	0·55	10140	1·418	Af
	Sabine bottom seam	250 6½—251 5	0 10½	90·5	236/60	..	..	..	18·9	..	..	..	..	..
		252 0½—254 11¼	2 10¾	98	211/60	3·7	40·1	34·0	22·2	19·69	0·44	10400	1·416	Cw
		255 0½—257 8¾	2 8¼	94	210/60	5·1	37·4	37·4	20·1		0·43	10730	1·399	Af/Cw
		258 6½—260 1¼	1 6¾	94·5	209/60	5·8	38·4	41·5	14·3		0·57	11580	1·350	Af/Cw
148	Sugarloaf working seam	197 5½—198 7¾	1 2¼	94·5	241/60	..	..	..	27·0	..	..	..	..	..
		199 0½—199 8	0 7½	100	240/60	..	..	..	29·5	..	..	..	..	..
		200 5 —201 10¾	1 5¾	100	221/60	4·4	36·5	34·2	24·9	18·56	0·39	10130	1·430	Af
		202 3½—204 0½	1 9	100	220/60	4·3	41·6	40·9	13·2		0·38	12010	1·337	Cw
	Sabine top seam ..	205 7¼—209 1¼	3 6	99	219/60	4·6	37·8	36·3	21·3	21·3	0·38	10580	1·407	Af
	Sabine bottom seam	211 5 —212 4¾	0 11¾	100	218/60	3·0	41·4	37·7	17·9	..	0·54	11260	1·372	Af
		213 4¼—213 7½	0 3¼	100	239/60	..	..	..	10·7	..	..	..	..	..
		213 10 —214 3¾	0 5¾	87	238/60	..	..	..	12·4	..	..	..	..	..
		214 9½—216 10¼	2 0¾	100	217/60	3·6	39·2	34·4	22·8	22·19	0·44	10690	1·400	Af/Cw
		216 11¾—218 11¾	2 0	91·5	216/60	4·6	35·5	35·4	24·5		0·39	10070	1·438	Af/Cw
		219 3¼—220 9¾	1 6½	100	215/60	5·1	38·1	39·3	17·5		0·50	11120	1·374	Af/Cw
162	Sugarloaf working seam	228 11 —230 5¾	1 6¾	100	242/60	..	..	..	28·4	23·37	..	..	..	..
		231 1 —232 11	1 10	100	226/60	4·3	40·4	36·2	19·1		0·33	11180	1·378	Cw
	Sabine top seam ..	235 10¾—239 4½	3 5¾	100	225/60	4·7	37·6	33·1	24·6	24·6	0·60	10080	1·428	Af
	Sabine bottom seam	246 1¼—249 0	2 10¾	95·5	224/60	4·5	40·0	37·1	18·4	21·44	0·40	11240	1·375	Cw
		249 3¾—252 0½	2 8¾	95·5	223/60	4·4	38·7	35·9	21·0		0·50	10760	1·393	Af/Cw
		252 8 —254 2	1 6	100	222/60	4·7	34·7	32·5	28·1		0·42	9970	1·479	Af

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
164	Sugarloaf working seam	225 1½—226 7¼	1 5¾	100	234/60	4·5	36·9	33·6	25·0	18·92	0·39	10050	1·423	Af/Cw
		227 0 —228 9½	1 9½	97·5	233/60	4·3	41·7	40·1	13·9		0·36	11840	1·329	Cw
	Sabine top seam ..	230 3½—234 1½	3 10	98	232/60	5·0	39·0	37·5	18·5	18·5	0·45	10860	1·377	Af/Cw
	Sabine bottom seam	238 2¾—239 1¾	0 11	100	231/60	4·8	38·3	38·7	18·2	..	0·51	10930	1·378	Af/Cw
		239 10 —241 5	1 7	100	230/60	3·1	40·8	32·3	23·8	24·45	0·51	10600	1·404	Af/Cw
		241 6 —242 6	1 0	100	229/60	3·9	33·8	24·1	38·2		0·43	8080	1·550	Af
		242 9½—245 2	2 4½	91	228/60	4·2	39·4	36·1	20·3		0·49	10890	1·391	Af/Cw
		245 4½—246 11½	1 7	92	227/60	5·2	35·6	36·4	22·8		0·46	10270	1·424	Af/Cw
166	Sabine bottom seam	238 11 —239 8½	0 9½	94·5	24/60	..	..	..	26·2	..	..	..	..	..
		239 10½—242 1½	2 3	96·5	23/60	5·7	36·8	35·1	22·4	..	0·44	10070	1·435	..
		242 9¾—245 0½	2 2¾	100	22/60	4·1	39·6	38·3	18·0	..	0·46	11170	1·384	..
167	Sabine bottom seam	252 4¾—253 3	0 10¼	100	28/60	..	..	..	28·1	..	..	..	..	..
		253 9 —254 4¼	0 7¼	100	27/60	..	..	..	16·6	..	..	..	..	..
		254 8¾—255 2¼	0 5½	100	26/60	..	..	..	24·5	..	..	..	..	..
		255 6¾—258 5½	2 10¾	100	25/60	4·7	39·8	38·7	16·8	..	0·50	11350	1·372	..
171	Sabine bottom seam	223 9 —224 6½	0 9½	100	1393/59	..	..	..	25·0	..	..	..	..	..
		224 9¾—225 3¼	0 5½	100	1392/59	..	..	..	18·4	..	..	..	..	..
		225 10¾—228 4	2 5¼	97·5	1387/59	4·7	39·2	36·4	19·7	..	0·52	10760	1·387	..
		229 1½—231 4	2 2½	92·5	1386/59	4·8	39·1	38·1	18·0	..	0·51	11060	1·378	..
173	Sabine bottom seam	250 4¾—250 11	0 6¼	100	1394/59	..	..	..	26·0	..	..	..	..	..
		251 3½—253 3¼	1 11¾	100	1389/59	4·9	38·5	35·6	21·0	..	0·48	10730	1·398	..
		253 8¾—257 6¾	3 10	92	1388/59	6·2	38·1	38·9	16·8	..	0·49	10940	1·373	..
174	Sugarloaf working seam	258 8½—260 0½	1 4	100	1396/59	..	..	..	34·3	..	..	..	..	..
		260 1½—263 6¼	3 4¾	89	1391/59	4·8	39·8	39·3	16·1	..	0·50	11450	1·355	..
	Sabine bottom seam	272 7½—273 0¾	0 5¼	100	1395/59	..	..	..	16·5	..	..	..	..	..
		273 7½—277 1¾	3 6¼	99·5	1390/59	4·5	40·5	39·5	15·5	..	0·49	12250	1·351	..
175	Sugarloaf working seam	185 7¼—187 6	1 10¾	95·5	1703/59	5·2	37·9	37·8	19·1	19·26	0·47	10590	1·399	..
		187 9 —190 1½	2 4½	92	1702/59	4·8	38·5	37·3	19·4		0·46	10900	1·397	..
	Sabine top seam ..	192 1½—193 1	0 11½	100	1757/59	..	..	..	35·3	21·45	..	..	..	..
		193 4½—195 7¼	2 2¾	89	1701/59	5·4	38·4	40·7	15·5		0·49	11380	1·374	..
	Sabine bottom seam	198 7¼—201 2¼	2 7	98·5	1700/59	4·2	37·8	33·0	25·0	22·94	0·51	9860	1·439	..
		201 7¾—204 3	2 7¼	92	1699/59	3·6	39·8	34·6	22·0		0·61	10560	1·402	..
		204 4¾—205 9¾	1 5	82·5	1698/59	4·0	38·3	36·0	21·7		0·58	10350	1·410	..
		206 2¼—208 10½	2 8¼	94	1697/59	5·1	37·2	40·0	17·7		0·57	10610	1·396	..
176	Sugarloaf working seam	151 3 —153 3½	2 0½	88	1710/59	5·3	35·7	35·2	23·8	19·71	0·51	9870	1·440	
		153 8¾—155 5½	1 8¾	100	1709/59	4·5	41·4	39·6	14·5		0·42	11480	1·354	..
	Sabine top seam ..	156 10 —160 3¾	3 5¾	82	1708/59	4·8	39·9	39·4	15·9	15·9	0·50	11140	1·372	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
176	Sabine bottom seam	165 2¾—167 2½	1 11¾	96	1707/59	4·9	36·0	40·2	18·9	19·89	0·50	10620	1·400	..
		167 11½—170 2¼	2 2¾	96·5	1706/59	4·5	36·5	32·6	26·4		0·53	9570	1·447	..
		170 3¾—171 6¾	1 3	100	1705/59	4·2	41·4	38·5	15·9		0·48	11240	1·356	..
		171 10 —174 0	2 2	100	1704/59	5·2	38·1	40·6	16·1		0·39	11060	1·380	..
181	Sugarloaf working seam	157 8¼—160 6½	2 10¼	91	1717/59	6·0	35·0	35·9	23·1	25·71	0·41	9750	1·445	..
		160 7¾—162 5¾	1 10	100	1716/59	5·5	35·1	29·6	29·8		0·48	8980	1·486	..
	Sabine top seam ..	163 9¼—165 2¾	1 5½	100	1758/59	..	..	..	28·1	22·39	..	..	..	..
		165 7½—167 9¼	2 1¾	100	1715/59	5·5	39·2	36·8	18·5		0·40	10470	1·398	..
	Sabine bottom seam	172 3¾—174 6¾	2 3	100	1714/59	4·8	39·0	35·4	20·8	18·93	0·48	10440	1·405	..
		175 7¾—178 0¼	2 4½	100	1713/59	4·1	39·5	33·3	23·1		0·44	10350	1·413	..
		178 1¼—180 7	2 5¾	100	1712/59	4·7	40·4	37·3	17·6		0·50	11000	1·377	..
		180 10 —182 9¼	1 11¼	100	1711/59	6·7	37·6	42·4	13·3		0·52	11350	1·367	..
182	Sugarloaf working seam	191 3¼—194 0¾	2 9½	100	1724/59	4·1	34·6	29·4	31·9	..	0·30	8840	1·503	..
		194 6½—196 4	1 9½	100	1723/59	4·7	36·1	33·6	25·6	18·16	0·34	9630	1·460	..
		196 5¾—198 10½	2 4¾	96·5	1722/59	4·7	41·4	41·3	12·6		0·34	12080	1·335	..
	Sabine top seam ..	200 8¾—204 5	3 8¼	97	1721/59	5·1	38·7	34·8	21·4	21·4	0·42	10270	1·415	..
	Sabine bottom seam	206 8¾—207 4¾	0 8	94	1759/59	..	..	..	23·7	..	..	..	..	..
		207 10¾—209 9¼	1 10½	100	1720/59	5·0	38·5	37·4	19·1	18·68	0·52	10610	1·400	..
		210 6¼—213 9	3 2¾	100	1719/59	5·0	37·7	36·8	20·5		0·43	10370	1·416	..
		214 0 —215 7	1 7	100	1718/59	5·3	39·7	41·2	13·8		0·56	11350	1·357	..
183	Sugarloaf working seam	221 10¼—223 6	1 7¾	100	1760/59	..	..	..	34·5	..	..	..	..	..
		223 10¾—225 4	1 5¼	100	1732/59	4·4	39·4	36·8	19·4	17·96	0·35	10790	1·395	..
		225 8¾—227 10½	2 1¾	100	1731/59	4·4	40·4	38·2	17·0		0·40	11170	1·374	..
	Sabine top seam ..	228 9½—232 8½	3 11	91·5	1730/59	4·4	38·9	34·9	21·8	21·8	0·44	10360	1·425	..
	Sabine bottom seam	234 4¼—236 0½	1 8¼	92·5	1729/59	3·8	35·1	29·3	31·8	22·98	0·40	8870	1·524	..
		236 2¼—237 11¼	1 9	95	1728/59	4·1	39·4	37·4	19·1		0·45	10720	1·394	..
		238 1¼—240 8¼	2 7	98·5	1727/59	3·7	39·1	32·2	25·0		0·62	9940	1·431	..
		240 8¾—242 5¼	1 8½	97·5	1726/59	4·8	37·3	39·1	18·8		0·48	10750	1·393	..
		242 7¾—244 3	1 7¼	97·5	1725/59	5·2	37·6	38·9	18·3		0·47	10590	1·394	..
184	Sugarloaf working seam	221 4¾—223 3¼	1 10½	100	1741/59	3·8	37·0	35·7	23·5	21·41	0·48	9840	1·460	..
		223 10½—225 6½	1 8	100	1740/59	3·7	38·8	33·9	23·6		0·39	10540	1·412	..
		225 11¾—227 8¾	1 9	100	1739/59	3·9	41·0	38·0	17·1		0·38	11460	1·361	..
	Sabine top seam ..	229 9¾—233 4¾	3 7	98 5	1738/59	4·1	39·0	35·9	21·0	21·0	0·37	10750	1·403	..
	Sabine bottom seam	234 7¼—236 5½	1 10¼	98	1737/59	3·8	40·6	37·6	18·0	19·06	0·43	11310	1·369	..
		236 6½—238 0½	1 6	100	1736/59	4·8	36·0	35·5	23·7		0·41	9990	1·436	..
		238 4¼—241 0	2 7¾	100	1735/59	3·7	39·8	35·3	21·2		0·45	10820	1·393	..
		241 2 —243 7¾	2 5¾	100	1734/59	4·4	40·0	38·3	17·3		0·39	11250	1·367	..
		243 9½—245 5	1 7½	100	1733/59	5·4	36·3	37·3	21·0		0·61	10370	1·413	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
185	Sugarloaf working seam	203 7½—204 11¾	1 4¼	100	1762/59	..	..	..	36·4	..	..	..	..	..
		205 3¼—206 4¼	1 1	100	1761/59	..	..	..	30·9		..	..	..	..
		206 10 —208 9	1 11	100	1749/59	4·9	37·9	37·8	19·4	20·48	0·41	10550	1·409	..
		209 4 —210 8¼	1 4¼	100	1748/59	5·0	39·5	41·9	13·6		0·54	11800	1·345	..
	Sabine top seam ..	212 7¼—216 4	3 8¾	94	1747/59	5·2	38·5	38·4	17·9	17·9	0·55	11030	1·389	..
	Sabine bottom seam	218 6½—220 5¾	1 11¼	95·5	1746/59	4·2	39·0	36·1	20·7		0·50	10790	1·404	..
		220 8¾—222 3¾	1 7	94·5	1745/59	4·3	37·2	33·5	25·0		0·46	10020	1·447	..
		222 7½—224 8	2 0½	97	1744/59	3·3	39·6	38·9	18·2	17·28	0·60	10230	1·433	..
		224 10 —227 5½	2 7½	94·5	1743/59	4·8	39·8	43·0	12·4		0·50	11100	1·391	..
		227 7¼—229 4½	1 9¼	97	1742/59	5·7	39·2	43·0	12·1		0·56	11700	1·351	..
186	Sugarloaf working seam	169 4¾—170 3	0 10¼	90	1765/59	..	..	..	22·4		..	..	..	..
		170 7¼—171 6¾	0 11½	100	1764/59	..	..	..	29·0	16·79	..	..	..	..
		172 5 —173 11½	1 6½	97·5	1756/59	4·4	39·0	38·1	18·5		0·44	11020	1·391	..
		174 5 —176 0½	1 7½	95	1755/59	4·8	40·5	41·1	13·6		0·46	11660	1·355	..
	Sabine top seam ...	178 1 —181 10½	3 9½	90·5	1754/59	4·8	40·4	40·0	14·8	14·8	0·47	11490	1·362	..
	Sabine bottom seam	185 4¼—185 10	0 5¾	100	1763/59	..	..	..	14·3	..	..	..	..	..
		186 2¼—188 7½	2 5¼	100	1753/59	5·6	39·8	38·3	16·3		0·53	11370	1·368	..
		189 0 —191 8¾	2 8¾	100	1752/59	4·4	40·0	35·9	19·7	18·69	0·45	10890	1·388	..
		191 9 —193 1¾	1 4¾	95·5	1751/59	4·5	39·7	38·0	17·8		0·45	11250	1·380	..
		193 4 —194 10	1 6	94·5	1750/59	4·7	35·4	39·3	20·6		0·45	10660	1·411	..
192	Sugarloaf working seam	150 6¾—152 10	2 3¼	100	1428/59	..	..	..	30·7	..	..	..	..	..
		153 2 —154 5½	1 3½	97	1427/59	..	..	..	23·7		..	..	..	..
		155 0½—158 3¾	3 3¼	100	1409/59	5·2	39·8	36·8	18·2	19·84	0·34	11140	1·381	..
193	Sugarloaf working seam	263 2¾—264 7¼	1 4½	100	1429/59	..	..	..	32·4	..	..	..	..	..
		265 0¼—266 4¾	1 4½	100	1411/59	4·5	36·8	32·9	25·8	20·47	0·34	9870	1·465	..
		266 10¾—269 9½	2 10¾	100	1410/59	4·7	39·6	37·4	18·3		0·49	11070	1·389	..
194	Sugarloaf working seam	148 10 —149 8½	0 10½	100	1430/59	..	..	..	30·1	..	..	..	..	..
		149 10¾—151 3½	1 4¾	95·5	1413/59	5·9	33·4	33·1	27·6	21·66	0·25	9330	1·487	..
		151 5¾—154 10	3 4¼	92·5	1412/59	5·0	38·6	37·2	19·2		0·35	10960	1·409	..
196	Sugarloaf working seam	143 6 —144 5¼	0 11¼	100	1416/59	5·3	38·9	33·5	22·3	..	0·36	10290	1·409	..
		144 5¼—145 11¾	1 6½	100	1431/59	..	..	..	34·6	..	..	..	..	..
		146 4¾—147 9½	1 4¾	100	1415/59	5·6	34·3	32·1	28·0	21·34	0·30	9300	1·474	..
		148 2 —150 10¼	2 8¼	100	1414/59	4·1	40·6	37·4	17·9		0·35	11770	1·374	..
197	Sugarloaf working seam	137 6 —138 3¾	0 9¾	100	1432/59	..	..	..	33·1	..	..	..	..	..
		138 8½—140 0½	1 4	100	1418/59	5·2	36·2	33·7	24·9	18·15	0·30	9880	1·462	..
		140 5 —143 5½	3 0½	94·5	1417/59	5·6	40·1	40·5	13·8		0·36	11590	1·352	..
198	Sugarloaf working seam	153 4 —153 11	0 7	100	1433/59	..	..	..	36·8	..	..	..	..	..
		154 5¾—155 11	1 5¼	100	1420/59	5·4	36·5	33·8	24·3	18·22	0·34	9970	1·442	..
		156 2 —159 4½	3 2½	100	1419/59	5·8	39·3	39·5	15·4		0·42	11280	1·366	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis				Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
						Moist. %	Vol. Mat. %	F.C. %	Ash %					
199	Sugarloaf working seam	283 3¾—285 1½ 285 8 —288 0½	1 9¾ 2 4½	95·5 81·5	1434/59 1421/59	.. 5·9	.. 37·7	.. 34·7	25·3 21·7	} 23·26 {	0·47	10300	1·412	.. ..
200	Sugarloaf working seam	150 11¼—152 2½ 152 8¼—154 2 154 7½—158 0¼	1 3 1 5¾ 3 4¾	96·5 97 99	1435/59 1423/59 1422/59	.. 5·6 5·6	.. 35·6 36·9	.. 33·0 36·0	22·8 25·8 21·5	} 22·80 {	.. 0·40 0·44	.. 9620 10450	.. 1·447 1·414	.. .. ..
205	Sugarloaf working seam	132 9 —133 9¾ 133 9¾—135 3 135 9½—137 1¾ 137 5¾—140 5½	1 0¾ 1 5¼ 1 4¼ 2 11¾	100 100 100 77	1426/59 1436/59 1425/59 1424/59	6·2 .. 5·9 5·3	39·0 .. 37·7 38·4	33·6 .. 36·1 38·7	21·2 39·4 20·3 17·6	.. .. } 18·44 {	0·33 .. 0·32 0·42	10560 .. 10560 11040	1·395 .. 1·393 1·373	.. ..

COAL RESOURCES, DARLING DOWNS (OAKEY) COALFIELD, WILLEROO MINE AREA

By D. C. MENGEL, B.Sc., Geologist

SUMMARY

During 1958-9, sixty-five boreholes aggregating 14,125 ft. 5 in. were drilled by the Department of Mines in the Willeroo Mine Area.

Three coal seams penetrated in these boreholes are described in detail. Drilling to the west of the Sabine Bottle Tree Hill road was designed primarily to test the working seam. East of the road a lower seam, the Sabine bottom seam, was the main objective.

As a result of drilling in the Willeroo Mine Area the following measured coal reserves have been proved:—

	Tons
Willeroo working seam	1,830,000
Sabine bottom seam—	
coal section A	350,000
coal section B	1,340,000
	3,520,000

One borehole was continued below these three seams to test underlying measures. Beds penetrated below 486 ft. in this borehole are believed to be local equivalents of the Marburg Sandstone.

INTRODUCTION

Willeroo Colliery is situated approximately two miles south-south-east of the town of Acland and is served by a siding from the Oakey-Cooyar Branch Railway.

Mining titles held by the colliery owners (J. Wright and others) are Coal Mining Leases 89, 90, 91, 107 and 128 and Coal Mining License 27, Toowoomba. Also considered in this report is that part of subsection 69, portion 799, parish of Watts which is not subject to any mining tenement. The mine area is divided by a north-south road from the vicinity of Sabine Siding to the Acland-Oakey Road near Bottle Tree Hill.

A programme of shallow diamond drilling was carried out in the mine area by the Department of Mines from 18th June, 1958 to 31st October, 1959, using a Sullivan 37 Plant. Drilling in the Willeroo Mine Area occupied approximately 41 weeks of this period. During the rest of the time the drill was operating in other mine areas. Interruptions to the programme were due to the need to fit in drilling over the whole coalfield with owners' use of land for agriculture.

In all, 65 Boreholes, including one redrill, were completed aggregating 14,125 ft. 5 in. This figure includes a footage of 1,292 ft. 10 in. for five boreholes which are common to both Willeroo and Sugarloaf Mine Areas. Boreholes ranged in depth from 102 ft. 0 in. (N.S. 203) to 800 ft. 4 in. (N.S. 209).

This report is accompanied by a table of recoveries and analyses and the following plans and diagrams:—

(1) Locality Map—figure 1.

(2) Plan of part of Willeroo Mine Area showing boreholes, mine workings, topography and boundaries of measured reserves—figure 2.

(3) Plan of part of Willeroo Mine Area showing boreholes, topography and boundary of measured reserves—figure 3.

(4) Cross sections—figure 4.

(5) Diagram of generalised bore section—figure 5.

(6) Diagrams of detailed seam sections in the colliery—figure 6.

(7) Diagrams of detailed seam sections in boreholes—figures 7–16.

MINING DEVELOPMENT

The first Willeroo Colliery was located approximately one mile to the north of Muldu on the eastern side of the Oakey-Cooyar Branch Railway. Operations commenced in 1921 in a seam which is correlated with the seam worked in the adjacent Balgowan Colliery. The mine was abandoned in 1943.

In 1931 a tunnel was driven to coal in subdivision 72, portion 801, parish Watts by the owners of Willeroo No. 1 Colliery. The mine that was subsequently developed there in 1940 is the present Willeroo No. 2 Colliery.

GENERAL GEOLOGY

The coal bearing beds of this coalfield are equivalent to the Walloon Coal Measures of Jurassic age. These strata are very susceptible to weathering processes and give rise to a fairly mature topography with a gently undulating land surface. Surface exposures, except for scattered boulders of sandstone and ironstone, are practically non-existent.

Tertiary basalt does not crop out in the Willeroo Mine Area but elsewhere in the district it occurs as flow remnants and cappings on low hills.

FIG. 1

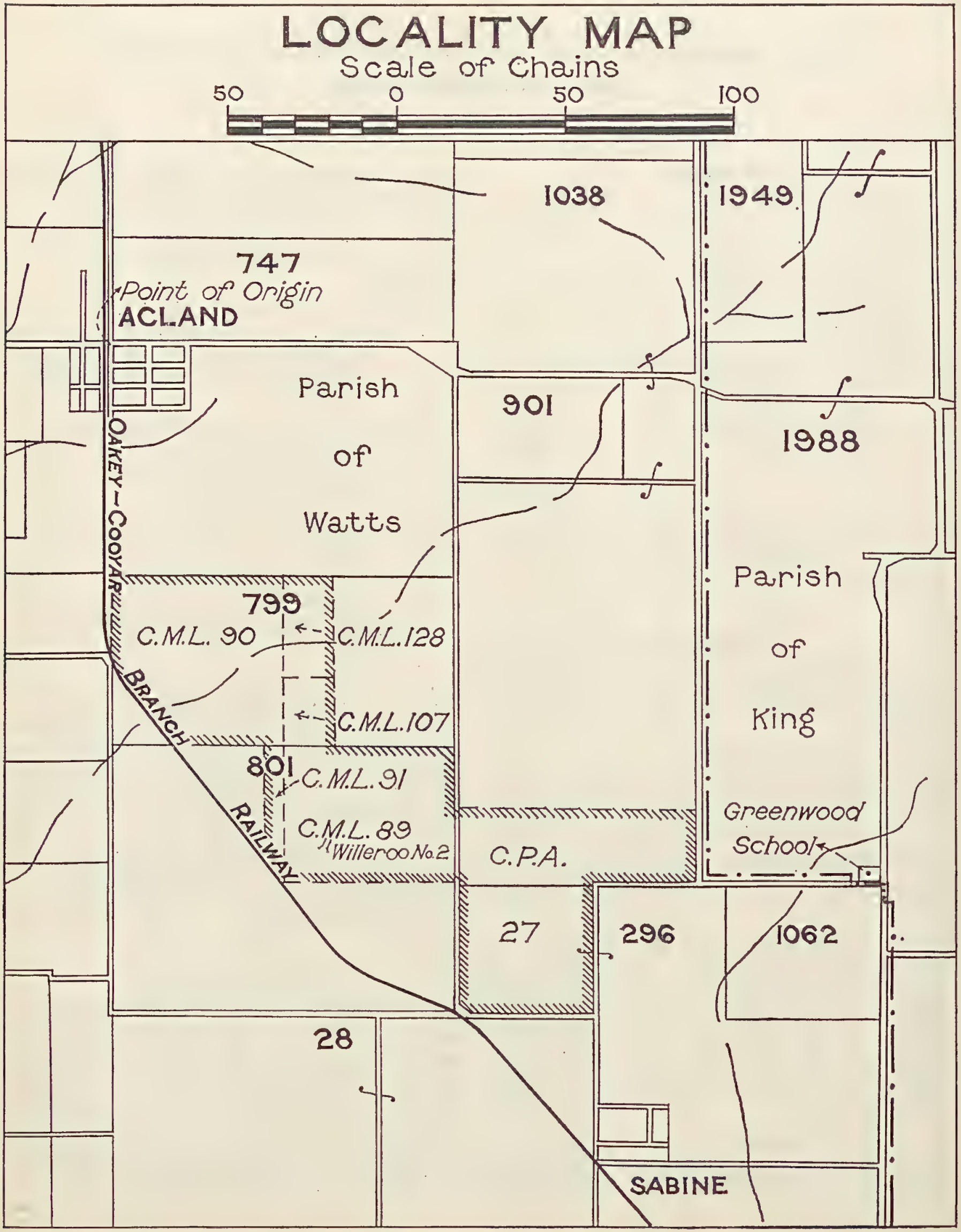

LOCALITY MAP
Scale of Chains
50 0 50 100
1038
1949
747
Point of Origin
ACLAND
Parish
of
Watts
901
1988
OAKEY-COOYAR
799
C.M.L. 90
C.M.L.128
C.M.L.107
BRANCH
801
C.M.L. 91
C.M.L. 89
Willeroo No.2
RAILWAY
C.P.A.
Parish
of
King
Greenwood
School
27
296
1062
28
SABINE

FIG. 2

N.S.76 R.L.Coll.1434·15 R.L.Btm.1280·15
N.S.79 R.L.Coll.1443·03 R.L.Btm.1296·28
N.S.89 R.L.Coll.1446·04 R.L.Btm.1316·76
N.S.90 R.L.Coll.1448·18 R.L.Btm.1316·76
N.S.75 R.L.Coll.1441·03 R.L.Btm.1318·45
N.S.93 R.L.Coll.1430·60 R.L.Btm.1305·77
N.S.97 R.L.Coll.1425·46 R.L.Btm.1285·90
N.S.98 R.L.Coll.1410·75 R.L.Btm.1285·50
N.S.114 R.L.Coll.1406·38 R.L.Btm.1281·21
N.S.204 R.L.Coll.1402·92 R.L.Btm.1215·42
N.S.129 R.L.Coll.1406·19 R.L.Btm.1249·44
N.S.106 R.L.Coll.1428·66 R.L.Btm.1287·66
N.S.74 R.L.Coll.1409·50 R.L.Btm.1285·25
N.S.112 R.L.Coll.1398·43 R.L.Btm.1283·93
N.S.113 R.L.Coll.1398·04 R.L.Btm.1291·54
N.S.115 R.L.Coll.1397·39 R.L.Btm.1292·17
N.S.203 R.L.Coll.1403·44 R.L.Btm.1301·44
N.S.210 R.L.Coll.1408·50 R.L.Btm.1262·25
N.S.73 R.L.Coll.1392·25 R.L.Btm.1268·00
N.S.116 R.L.Coll.1391·25 R.L.Btm.1269·17
N.S.117 R.L.Coll.1394·60 R.L.Btm.1274·52
N.S.72 R.L.Coll.1389·97 R.L.Btm.1210·97
N.S.71 R.L.Coll.1383·73 R.L.Btm.1226·48
N.S.70 R.L.Coll.1382·56 R.L.Btm.1262·98
N.S.69 R.L.Coll.1384·63 R.L.Btm.1244·88
N.S.202 R.L.Coll.1403·46 R.L.Btm.1285·29
N.S.137 R.L.Coll.1408·16 R.L.Btm.1256·49
N.S.201 R.L.Coll.1403·96 R.L.Btm.1218·96
N.S.180 R.L.Coll.1415·48 R.L.Btm.
N.S.209 R.L.Coll.1396·11 R.L.Btm.595·78
N.S.208 R.L.Coll.1407·58 R.L.Btm.1172·53
N.S.207 R.L.Coll.1413·67 R.L.Btm.1189·50
N.S.138 R.L.Coll.1421·15 R.L.Btm.1241·90
N.S.130 R.L.Coll.1405·54 R.L.Btm.1193·45
N.S.85 R.L.Coll.1411·96 R.L.Btm.1203·71
N.S.139 R.L.Coll.1420·45 R.L.Btm.1240·36
N.S.81 R.L.Coll.1406·47 R.L.Btm.1211·39
N.S.84 R.L.Coll.1411·96 R.L.Btm.1203·71
N.S.140 R.L.Coll.1422·03 R.L.Btm.1222·45
N.S.83 R.L.Coll.1412·07 R.L.Btm.1197·07
N.S.141 R.L.Coll.1424·54 R.L.Btm.1193·79
N.S.169 R.L.Coll.1393·83 R.L.Btm.1167·83
N.S.170 R.L.Coll.1402·64 R.L.Btm.1184·64
N.S.82 R.L.Coll.1410·50 R.L.Btm.1220·08
N.S.206 R.L.Coll.1417·06 R.L.Btm.1193·89
N.S.142 R.L.Coll.1427·53 R.L.Btm.1153·78

Sub.70 Sub.69 Sub.71 Sub.72
799 801
S1 S2 S3 S4 S5 S6
A A' B B' C
Old workings Old workings
Dam
OAKEY COOYAR BRANCH
SUGARLOAF No3 SUGARLOAF A
WILLEROO No.2
RLY.
8000S 10000S 12000S 14000S 16000S
2000E

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

WILLEROO MINE AREA

DARLING DOWNS (OAKEY) COALFIELD

Showing boreholes, mine workings, topography, & boundaries of measured reserves

To accompany report by D.C.Mengel B.Sc.

Scale of Chains

5 0 5 10 15

Twenty Chain Grid on True North. Point of Origin, N.W. Corner Sub66A Por.747 Parish of Watts
Elevations in feet on State Datum

LEGEND

- Underground fault — position accurate
- " " approximate
- " " indefinite
- Surface contours
- Colliery
- " (abandoned)
- Seam section measured
- Adit
- Shaft
- Diamond drillhole
- Section line
- Limit of mine workings :— Willeroo working seam (25/5/61)
- Boundaries of measured reserves :—
  - Willeroo working seam
  - Sabine btm. seam — Section B
  - " " — Section A

WILLEROO
WILLEROO A
N.S.00

N.J.H.

SUBSURFACE GEOLOGY

(a) The Coal Measures

The coal measures of this area consist essentially of light-grey shales, siltstones, fine grained sandstones and several coal seams. Lenticular beds of ironstone are present and these generally crop out as weathered boulders. Thin beds of impure limestone, often showing cone-in-cone structure, also occur in the strata.

The full thickness of coal measures is unknown. One borehole (N.S. 209) penetrated to the underlying non-productive beds and passed through at least 486 ft. of coal measures. (In the type area at Rosewood the maximum proved thickness is 700 ft.).

The strata cored in the boreholes were sparsely fossiliferous. Generally fossil plant remains were too fragmentary for even generic determination.

(b) The Coal Seams

As in the Sugarloaf and Acland Mine Areas three coal seams were penetrated in drilling in the Willeroo Mine Area. These seams are referred to, in descending stratigraphic order, in this report as—

(i) Willeroo working seam
(ii) Sabine top seam
(iii) Sabine bottom seam

The Willeroo working seam is the only seam of economic interest to the west of the Sabine–Bottle Tree Hill road. This seam deteriorates to the east of the road and is unworkable except along the southern boundary of C.P.A. 27.

The Sabine top seam is unworkable to the west of this road where it is only 2 to 3 ft. thick. The seam thickens to the east and south-east and is also workable in boreholes along the southern boundary of C.P.A. 27.

The Sabine bottom seam is best developed in the south-eastern part of the mine area (C.P.A. 27). To the north-west the seam deteriorates and shale bands separating the coal sections thicken.

The strata between the seams are thinnest in the area between boreholes N.S. 139-143.

(i) Willeroo working seam

The Willeroo working seam is the lower part of a sequence of coal and shale bands approximately 30 ft. thick. West and north-west of the mine workings (C.M.L. 90) this sequence is split about 15 ft. from the base by beds of shale and fine sandstone or siltstone which range up to 10 ft. in thickness (cf. Sugarloaf Mine Area). The seam is equivalent to the Acland working seam which has been described fully in a previous report (Mengel, 1963b).

This seam has a working thickness ranging up to 6 ft. The "top coal" is not worked in many places and the normal roof of the workings is immediately above the "top band" which is consequently called the "roof band". Throughout the colliery both "middle" and "bottom coals" are worked except in the southern part where only the "bottom coal" was worked (see figure 6, S.6). The "twin band" (Mengel, 1963c), near the base of the "middle coal" is persistent as at Sugarloaf Colliery.

The "bottom coal" generally is more uniform in quality and has a lower ash content than the "middle" and "top coals". In the mine workings in the southern part of C.M.L. 107 (i.e. part of subdivision 69, portion 799) a band of carbonaceous shale, or in some places grey shale, which may contain iron carbonate nodules is present near the top of the "bottom coal". This band is only a few inches thick in the eastern part of C.M.L. 107 (see S.3) but thickens westwards (see S.1) to such an extent that development was stopped in that direction. This general deterioration of the "bottom coal" is also shown in boreholes N.S. 69-72 to the west of these mine workings. The seam there is of normal thickness and is composed mainly of carbonaceous shale. In the easterly heading towards N.S. 130 this carbonaceous shale band is also present. (See S.4).

In boreholes in subdivision 72, portion 801 and subdivision 69, portion 799, seam sections are essentially similar to those in the mine workings. The "top coal" is widely variable in regard to quality and thickness of coal and in number and thickness of shale bands. The total thickness of "middle coal" is approximately 1 ft. 6 in. but not all is of workable quality. The "bottom coal" ranges in thickness from 2 ft. 8 in (N.S. 81) to 4 ft. 4 in. (N.S. 137), averaging 3 ft. 4½ in. In some boreholes a carbonaceous shale band occurs about 1 ft. from the top of the "bottom coal". This band reaches a maximum thickness of 6½ in. in N.S. 207.

Boreholes along the eastern margin of C.M.L. 89 indicate a deterioration in the quality of coal in the seam. Thick carbonaceous shale bands are present in the "middle" and "bottom coals". This deterioration continues to the south-east and east in C.P.A. 27 where, except along the southern boundary and in isolated boreholes (e.g. N.S. 153), the seam is represented by carbonaceous shale bands. Along the southern boundary of C.P.A. 27 there is a section of approximately 4 ft. in the "middle" and "bottom coals".

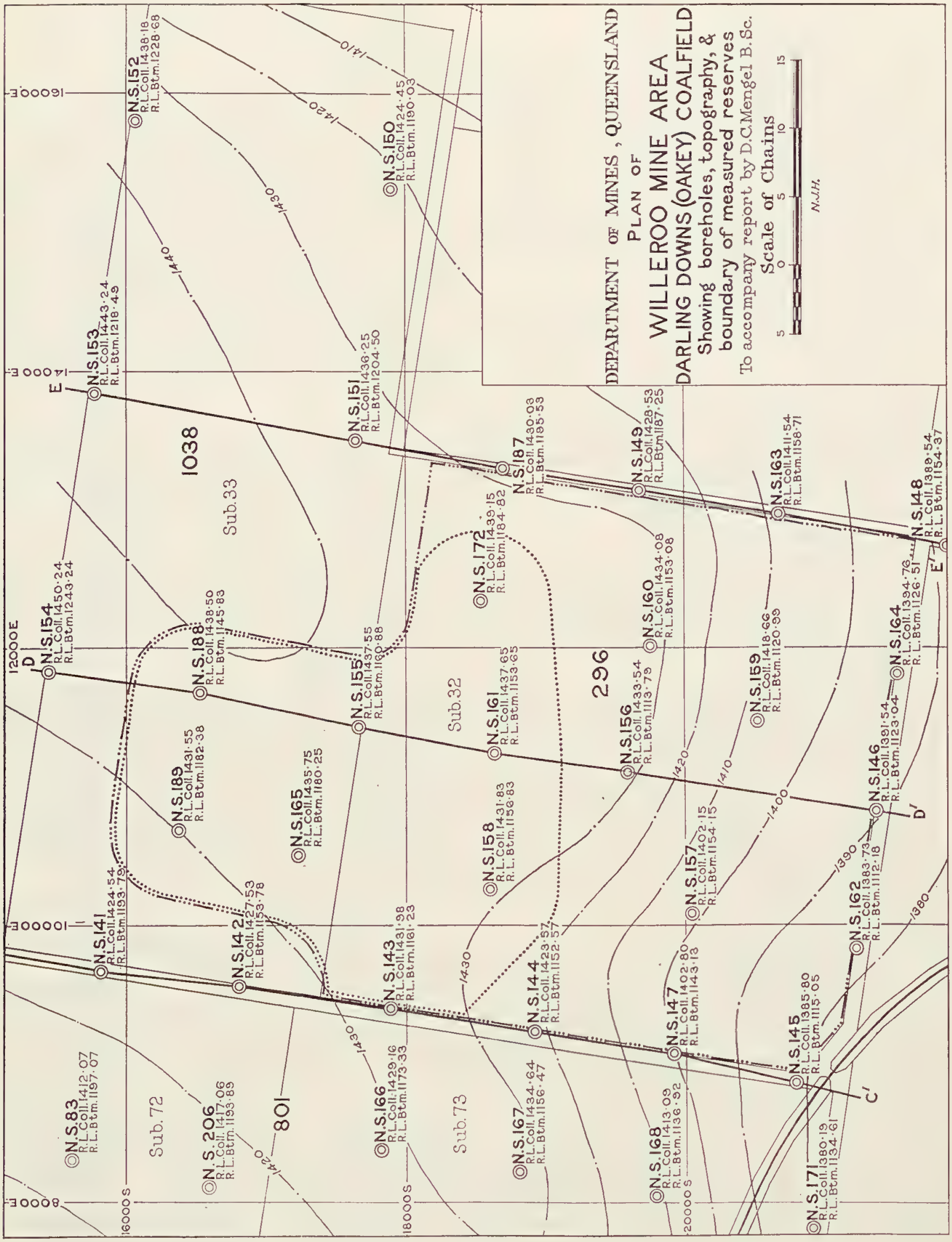
(ii) Sabine top seam

This seam is separated from the Willeroo working seam by shale or interbedded sandstone and shale. The interval between these seams is only a few inches in the area between N.S. 139 and 144. It increases to 7 ft. 8 in. (N.S. 204) in the north, 12 ft. 6½ in. (N.S. 169) in the west, and 11 ft. 8 in. (N.S. 157) in the south of the mine area. In most boreholes in C.P.A. 27 it is between 2 and 5 ft. thick.

In C.P.A. 27 the seam has an average thickness of 3 ft. 9 in. but is of economic interest only along the southern boundary of this part of the area. Here the seam consists of thick coal bands separated by three or four light coloured shale bands. Elsewhere these shale bands are more numerous.

In subdivision 72, portion 801 and subdivision 69, portion 799 the seam is between 2 and 3 ft. thick.

FIG.3

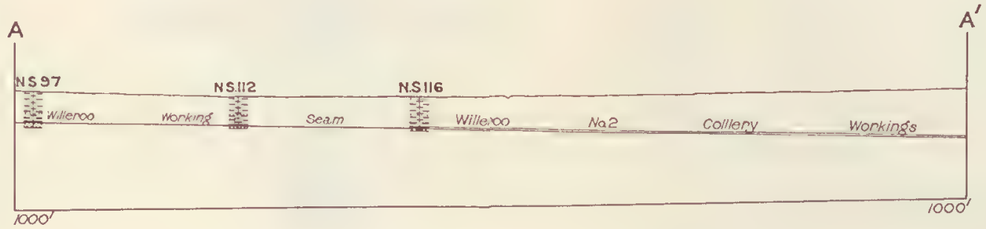

DEPARTMENT OF MINES, QUEENSLAND
PLAN OF
WILLEROO MINE AREA
DARLING DOWNS (OAKEY) COALFIELD
Showing boreholes, topography, & boundary of measured reserves
To accompany report by D.C.Mengel B.Sc.
Scale of Chains
5 0 5 10 15
N.J.H.
1038
Sub.33
296
Sub.32
801
Sub.72
Sub.73
N.S.153 R.L.Coll.1443·24 R.L.Btm.1218·49
N.S.152 R.L.Coll.1438·18 R.L.Btm.1228·68
N.S.150 R.L.Coll.1424·45 R.L.Btm.1190·03
N.S.151 R.L.Coll.1436·25 R.L.Btm.1204·50
N.S.187 R.L.Coll.1430·03 R.L.Btm.1195·53
N.S.149 R.L.Coll.1428·53 R.L.Btm.1187·25
N.S.163 R.L.Coll.1411·54 R.L.Btm.1158·71
N.S.148 R.L.Coll.1389·54 R.L.Btm.1154·37
N.S.172 R.L.Coll.1439·15 R.L.Btm.1184·82
N.S.154 R.L.Coll.1450·24 R.L.Btm.1243·24
N.S.188 R.L.Coll.1438·50 R.L.Btm.1145·83
N.S.155 R.L.Coll.1437·55 R.L.Btm.1160·88
N.S.189 R.L.Coll.1431·55 R.L.Btm.1182·38
N.S.165 R.L.Coll.1435·75 R.L.Btm.1180·25
N.S.161 R.L.Coll.1437·65 R.L.Btm.1153·65
N.S.158 R.L.Coll.1431·83 R.L.Btm.1156·83
N.S.156 R.L.Coll.1433·54 R.L.Btm.1113·79
N.S.160 R.L.Coll.1434·08 R.L.Btm.1153·08
N.S.159 R.L.Coll.1418·66 R.L.Btm.1120·99
N.S.164 R.L.Coll.1394·76 R.L.Btm.1126·51
N.S.141 R.L.Coll.1424·54 R.L.Btm.1193·79
N.S.142 R.L.Coll.1427·53 R.L.Btm.1153·78
N.S.143 R.L.Coll.1431·98 R.L.Btm.1161·23
N.S.144 R.L.Coll.1423·57 R.L.Btm.1152·57
N.S.157 R.L.Coll.1402·15 R.L.Btm.1154·15
N.S.146 R.L.Coll.1391·54 R.L.Btm.1123·04
N.S.147 R.L.Coll.1402·80 R.L.Btm.1143·13
N.S.145 R.L.Coll.1385·80 R.L.Btm.1115·05
N.S.162 R.L.Coll.1383·73 R.L.Btm.1112·18
N.S.83 R.L.Coll.1412·07 R.L.Btm.1197·07
N.S.206 R.L.Coll.1417·06 R.L.Btm.1193·89
N.S.166 R.L.Coll.1429·16 R.L.Btm.1173·33
N.S.167 R.L.Coll.1434·64 R.L.Btm.1156·47
N.S.168 R.L.Coll.1413·09 R.L.Btm.1136·92
N.S.171 R.L.Coll.1380·19 R.L.Btm.1134·61
1410
1420
1440
1430
1400
1390
1380
E
E'
D
D'
C'
16000E
14000E
12000E
10000E
8000E
16000S
18000S
20000S

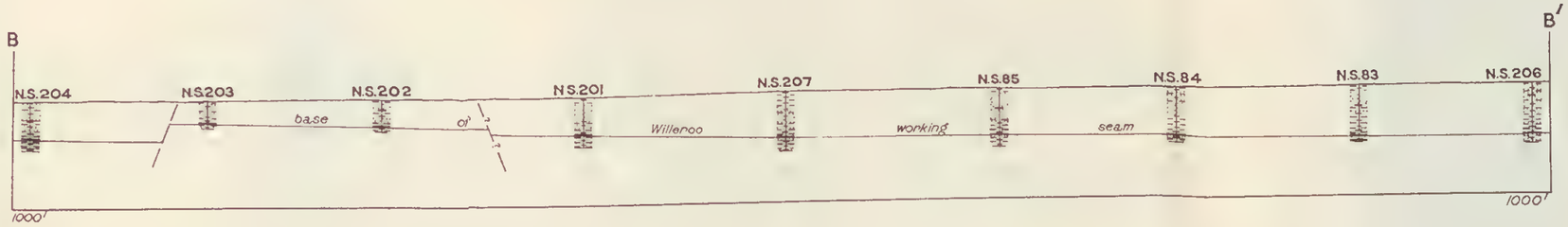
WILLEROO MINE AREA
CROSS SECTIONS

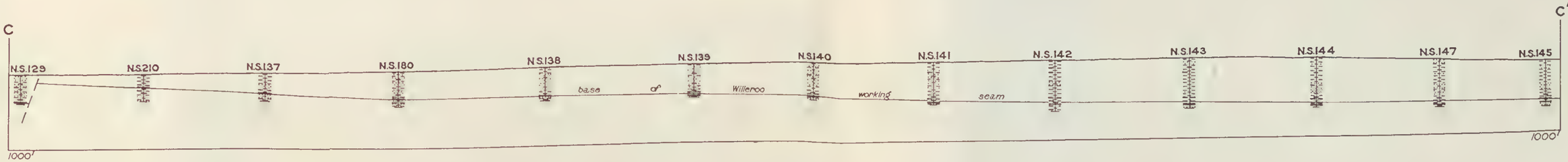
Scale of Chains

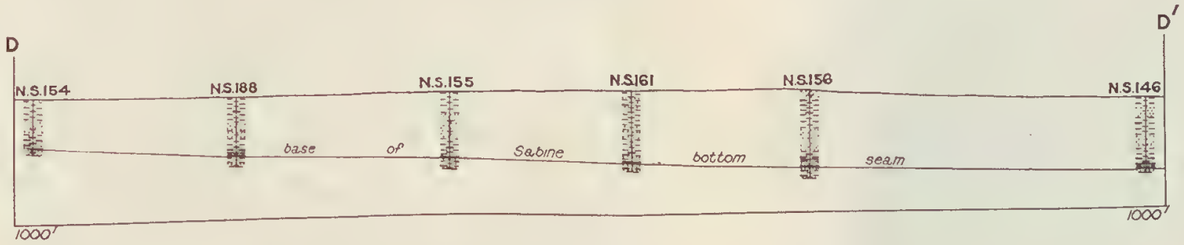
10 8 6 4 2 0 10

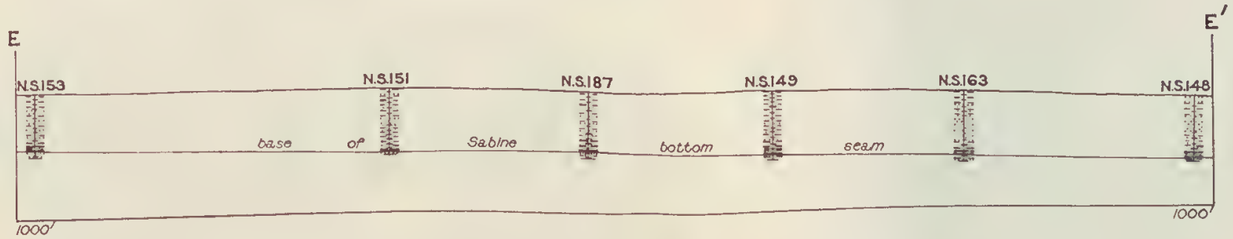
N.J.H.







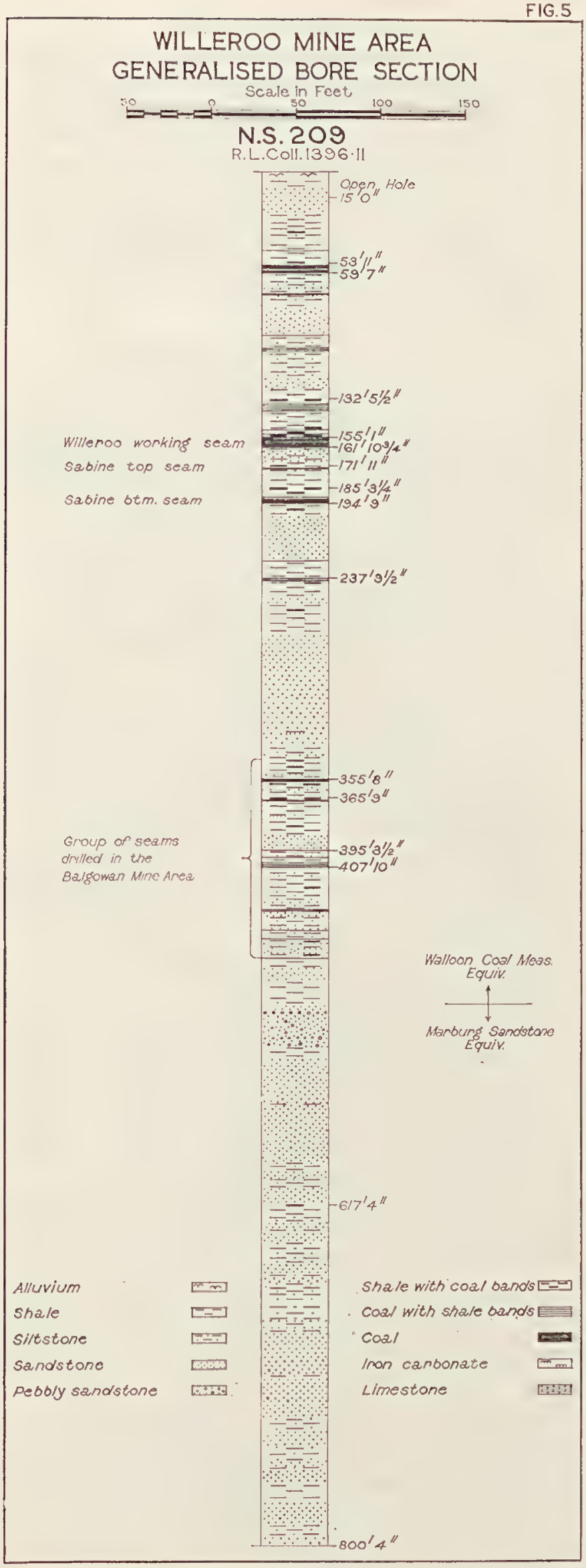




LEGEND

Sandstone		Coal	
Siltstone		Coal with shale bands	
Shale		Shale with coal bands	

FIG.5



(iii) Sabine bottom seam

In the vicinity of boreholes N.S. 83, 84, 139, and 140 the Sabine top and bottom seams are separated by a 1 ft. band of shale or siltstone. To the north and north-west of this area the strata between these seams increase in thickness to approximately 8 ft. (N.S. 201, 209) and consist of shale interbedded with fine sandstone or siltstone. To the south and south-east in C.P.A. 27 the interval also increases to a maximum of 8 ft. (N.S. 156).

The Sabine bottom seam has been described in a previous report (Mengel, 1963c) as consisting of three coal sections A, B and C separated by two persistent shale bands X and Y.

In boreholes in C.P.A. 27 the uppermost coal section (A) ranges in thickness from 2 ft. 5 in. (N.S. 162) to 3 ft. 9½ in. (N.S. 165). It is a banded section with thick coal bands separated by carbonaceous and light coloured shale bands. It is workable over the northern half of C.P.A. 27.

Band X, which is easily recognisable and is present in all boreholes, consists of light coloured shale and is normally only a few inches thick. This band thickens to the north-west.

In most boreholes in C.P.A. 27 coal section B is between 4 and 6 ft. thick. Average thickness of workable coal is 4 ft. 6¾ in. This section contains a few carbonaceous and light coloured shale bands. One of these, a light grey shale band which occurs in the middle of the section, is most persistent. It is normally only a few inches thick and, in this part of the mine area, reaches a maximum thickness of 9 in. (N.S. 143). It increases in thickness to the north-west.

In the south-eastern part of C.P.A. 27 band Y consists of light coloured shale 1 to 6 inches thick. The thickness increases to the north-west, where some sandstone is present in this band, to a maximum of 4 ft. 3½ in. at N.S. 154.

Coal section C is a banded section which ranges in thickness from 1 ft. 1 in. (N.S. 161) to 1 ft. 7½ in. (N.S. 164). It is workable only along the southern margin of C.P.A. 27.

To the north-west of C.P.A. 27 in subdivision 72, portion 801 and subdivision 69, portion 799 the seam deteriorates and is represented by coal and carbonaceous shale bands separated by thick shale bands.

(c) Possible Marburg Sandstone Equivalents

Borehole N.S. 209 penetrated to a depth of 800 ft. 4 in. Below 486 ft. 5 in., a sequence of sandstones with subordinate shale and siltstone beds was encountered. In this sequence fine sandstones occur interbedded with medium and coarse sandstones sometimes carrying pebble bands.

The finer grained clastic sediments are predominantly light grey in colour and are similar lithologically to those which characterize the coal measures.

The coarser sandstones consist mainly of poorly sorted quartz grains with some lithic fragments set in a clayey matrix. A soft white mineral is possibly a product of partial decomposition of felspars. Pebble

beds a few inches thick and containing pebbles ranging in diameter up to 1 in. are present. The first of these pebble beds was met at approximately 491 ft.

A thin ply of inferior coal was penetrated at 617 ft. 4 in. In the hand specimen it closely resembles the coal of the overlying seams. Microscopic examination (see appendix) showed that the spore assemblage closely resembles that usually found in the Marburg Sandstone and Walloon Coal Measures of the type area at Rosewood. This assemblage is quite different from that of the Bundamba Group. Hence the strata below 486 ft. in N.S. 209 must be the equivalent of either the Walloon Coal Measures or the Marburg Sandstone and not of the Bundamba Group.

The essential differences between Walloon and Marburg strata lies in the maximum grain size of the sediments and this has been pointed out by Reid (1922, p. 11) who said the Marburg beds had "a gritty character not found in the Rosewood beds" (Walloon Coal Measures). Therefore, based on lithological evidence, these strata are almost certainly equivalents of the Marburg Sandstone.

Lithologically similar sandstones were penetrated in N.S. 62 in the Balgowan Mine Area. Similar rocks crop out near Kulpi to the north of this area and they have been mapped as Bundamba Group in the Geological Map of the Moreton District (1955). On the basis of the foregoing evidence it is strongly suggested that these rocks are the local equivalents of the Marburg Sandstone.

STRUCTURAL GEOLOGY

The regional dip of the coal measures is less than 5 degrees in a general southerly direction. Local irregularities occur in both angle and direction of dip.

Two general directions of faulting are evident in this coalfield, i.e. approximately N.E.–S.W. and N.W.–S.E. It is highly probable that any faulting in this mine area will reflect this general pattern.

Mining operations have not been hindered by faulting. The few minor faults which have been encountered in the mine workings strike approximately N.E.–S.W. Only one of these faults could be inspected and it appears to be a normal fault with a downthrow of 15 ft. to the north-west. Irregularities in the direction and angle of dip are noticeable in the mine workings. Even local reversals of dip sometimes occur.

A major fault has been disclosed by drilling in the north-eastern part of subdivision 69, portion 799 but insufficient information is available for any detailed explanation of the structure in this area. The Willeroo working seam has been downthrown in N.S. 129 and 204. This may be explained by postulating a fault with a throw of 70 to 100 ft. striking N.W.–S.E. between N.S. 129 and 210 and N.S. 204 and 114.

Reduced levels of the floor of the Willeroo working seam in N.S. 180, 137 and 210 are anomalous. These anomalies may be due either to a local steepening or to minor faulting. A similar anomaly occurs between N.S. 201 and 202.

NATURE OF COAL

The coal from all sections analysed is distinctive with a high percentage of volatiles. It is classified as perhydrous (Seyler's classification based on type) because of its high cuticle and spore exine content.

In rank the coal is high volatile A to B bituminous (A.S.T.M. classification). On a dry, mineral-matter-free basis, fixed carbon ranges from 46·22 to 53·37 per cent. Calorific value, calculated on a moist, mineral-matter-free basis and excluding a few anomalous figures ranges from 13,500 to 14,200 B.T.U.s per lb.

Coking properties are weak to negligible.

COAL RESOURCES

In the Willeroo Mine Area an estimate has been made of measured coal reserves only. To be included in this category, a coal section must satisfy the following arbitrary conditions:—

(i) A minimum coal thickness of 3 ft.

(ii) An ash content, after the extraction of bands normally removed in mining, of not more than 25 per cent.

(iii) A depth below the surface of at least 50 ft.

(iv) Points of observation (e.g. borehole, perimeter of mine workings, &c.) should not be more than 12½ chains apart.

The area of measured reserves has been defined as extending no more than 5 chains beyond a peripheral point of observation.

No allowance has been made for the loss of coal in mining or the unavailability of coal due to faulting except in the north-western part of subdivision 69, portion 799.

In the area under consideration coal reserves have been proved in the following seams:—

(i) Willeroo working seam

Drilling in subdivision 69, portion 799 and subdivision 72, portion 801 (C.M.L. 89) has proved measured coal reserves in this seam in an area of 254 acres. The average workable coal thickness is 4 ft. 4 in. in the "middle" and "bottom coals". Reserves of 1,830,000 tons have been calculated.

Mining in the north-western corner of subdivision 69, portion 799 may be restricted by major faulting, and localised thinning of the seam in the vicinity of N.S. 115. In other boreholes in this locality the seam was of workable thickness. This part of the mine area was excluded from estimations of reserves but it is almost certain that some mining will be carried out there.

Owing to the excessive distance between boreholes, the area to the south, south-east and east of N.S. 117 has been disregarded in estimation of reserves. However, because of the workable seam sections in surrounding boreholes (except N.S. 115 to the north) it is probable that a high proportion of this area contains workable coal.

There are small reserves of coal in this seam adjacent to the southern boundary of C.P.A. 27. These would be best exploited in conjunction with coal reserves already proved in C.P.A. 29 (Sugarloaf Mine Area) to the south.

(ii) Sabine top seam

Minor reserves in this unworked seam are available along the southern boundary of C.P.A. 27. This coal also would be best exploited from C.P.A. 29.

(iii) Sabine bottom seam

This seam has not been worked in the coalfield.

Measured reserves in coal section B have been calculated over an area of 177 acres in C.P.A. 27. Average thickness of coal in this section is 4 ft. 6¾ in. and measured reserves amount to 1,340,000 tons.

In the northern half of C.P.A. 27 the upper coal section A is also workable. Additional reserves of 350,000 tons in this section have been calculated over an area of 78 acres. Average total thickness of this section is 2 ft. 10 in. The quality of the coal is inferior to that in the lower sections and ash contents of most borehole samples lie between 25 and 27 per cent. If sections A and B are worked concurrently, the resultant product should be marketable.

Some coal may be mined in the vicinity of N.S. 142 if coal section B, which has thinned to 2 ft. 10 in., is worked together with coal section A.

Coal Section C is of good quality in boreholes N.S. 146, 148, and 162-164 along the southern boundary of C.P.A. 27. This coal, which averages 1 ft. 7 in. in thickness, may be worked with coal section B in this part of the mine area.

CONCLUSION

The following measured coal reserves have been proved as a result of the drilling programme in the Willeroo Mine Area:—

	Tons
Willeroo working seam	1,830,000
Sabine bottom seam—	
Coal section A	350,000
Coal section B	1,340,000

Seam sections in marginal boreholes indicate that prospects for the extension of these reserves exist in two areas:—

(i) To the east of subdivision 69, portion 799 (Willeroo working seam).

(ii) To the east of subdivision 32, portion 296 (all three seams but particularly the Sabine bottom seam).

On lithological evidence the strata below 486 ft. in N.S. 209 are almost certainly the local equivalents of the Marburg Sandstone.

REFERENCES

HILL, D. and TWEEDALE, G. W., 1955: Geological map of the Moreton district with parts of the Darling Downs, Burnett and Wide Bay districts, Queensland. Qld Dep. Mines, Brisbane.

MENGEL, D. C., 1963a: Coal resources, Darling Downs (Oakey) coalfield, Balgowan mine area. *Geol. Surv. Qld Publ., 314, 1-5.*

———, 1963b: Coal resources, Darling Downs (Oakey) coalfield, Acland mine area. *Geol. Surv. Qld Publ., 314, 6-25.*

———, 1963c: Coal resources, Darling Downs (Oakey) coalfield, Sugarloaf mine area. *Geol. Surv. Qld Publ., 315, 1-22.*

WHITEHOUSE, F. W., 1955: The geology of the Queensland portion of the Great Artesian Basin. Appendix G in Artesian water supplies in Queensland. Dep. Co-ord. Gen. Public Works, *Parl. Pap. A, 56–1955, Brisbane.*

6th August, 1962.

FIG.6

WILLEROO MINE AREA – DETAILED COLLIERY SECTIONS
WORKING SEAM

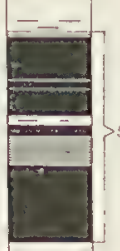
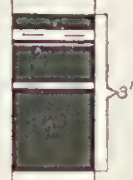
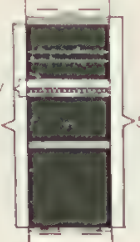
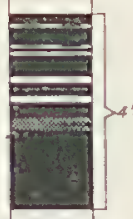
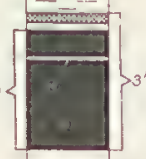
Prox. Analysis S., Cal. Val., & S.G.	Section Sampled	S.1	Description	Prox. Analysis S., Cal. Val., & S.G.	Section Sampled	S.2	Description	Prox. Analysis S. Cal. Val., & S.G.	Section Sampled	S.3	Description
	Not sampled		3" wh. sh. 1½" carb. sh. 1'0" coal ½" l gy. sh. 2" coal ½" l gy. sh. 7" coal 3" shale 3" coal 3" carb. sh. 5'0½" 1'10" coal	M.% 4·7 V.M.% 39·4 F.C.% 37·9 A.% 18·0 S.% 0·43 Joules/Gm. 26470 B.T.U./lb. 11390 S.G. 1·38 Coking test Class. Cw S.I. 1 1341/59	Excld. Excld. Excld.		Roof:– coal 4½" f wn sh. 1" carb. sh. 1" dk. gy. sh. 4½" coal ¾" brn. sh. 4½" coal ¼" brn sh. 1¼" coal ½" dk. brn sh. 4" coal 3¾" f wn. sh. 2½" carb. sh. ¾" gy. sh 5'10¼" 3'3¼" coal 1½" f wn. sh. 4½" coal Floor:– sh.	Not sampled		4½" coal 3" gy. sh. 1" coal 1½" l gy–gy. sh. 10½" coal 3'9½" 2" gy. sh. 2'0" coal
		S.4				S.5				S6	
M.% 4·8 V.M.% 39·6 F.C.% 37·3 A.% 18·3 S.% 0·45 Joules/Gm. 26050 B.T.U./lb. 11210 S.G. 1·36 Coking test Class. Cw S.I. 1	Excld. 1342/59		Roof:– f wn sh. 2¼" f wn sh. 2¼" carb. sh. 8" coal ½" gy. sh. 2" coal ½" gy. sh. 5" coal ½" carb. sh. 2" f wn. sh. 1½" inf. coal 1" gy – dk. gy sh. 1'1" coal 2¼" carb. sh. 1'11" coal 1" dk. gy. – carb. sh. 1¼" f wn. sh. Floor:– coal		Not sampled		3" coal 1" l gy sh. 5" coal 1" sh. 1" coal 1" sh. 6" coal 2" l gy. sh. 3½" coal 2" l gy. sh. 4" coal 4" shaly coal 4'8½" 1'11" coal	M.% 5·4 V.M.% 38·4 F.C.% 38·4 A.% 17·8 S.% 0·53 Joules/Gm. 25790 B.T.U./lb. 11100 S.G. 1·37 Coking test Class. Cw S.I. 1 1343/59		Roof:– coal & sh. bands 3½" f wn sh. 3" inf. coal " dk gy. sh. 1½" f wn. sh. 8" coal 1" carb sh. 3'4" 2'2" coal Floor:– f wn. sh.

FIG. 7

WILLEROO MINE AREA—DETAILED SEAM SECTIONS

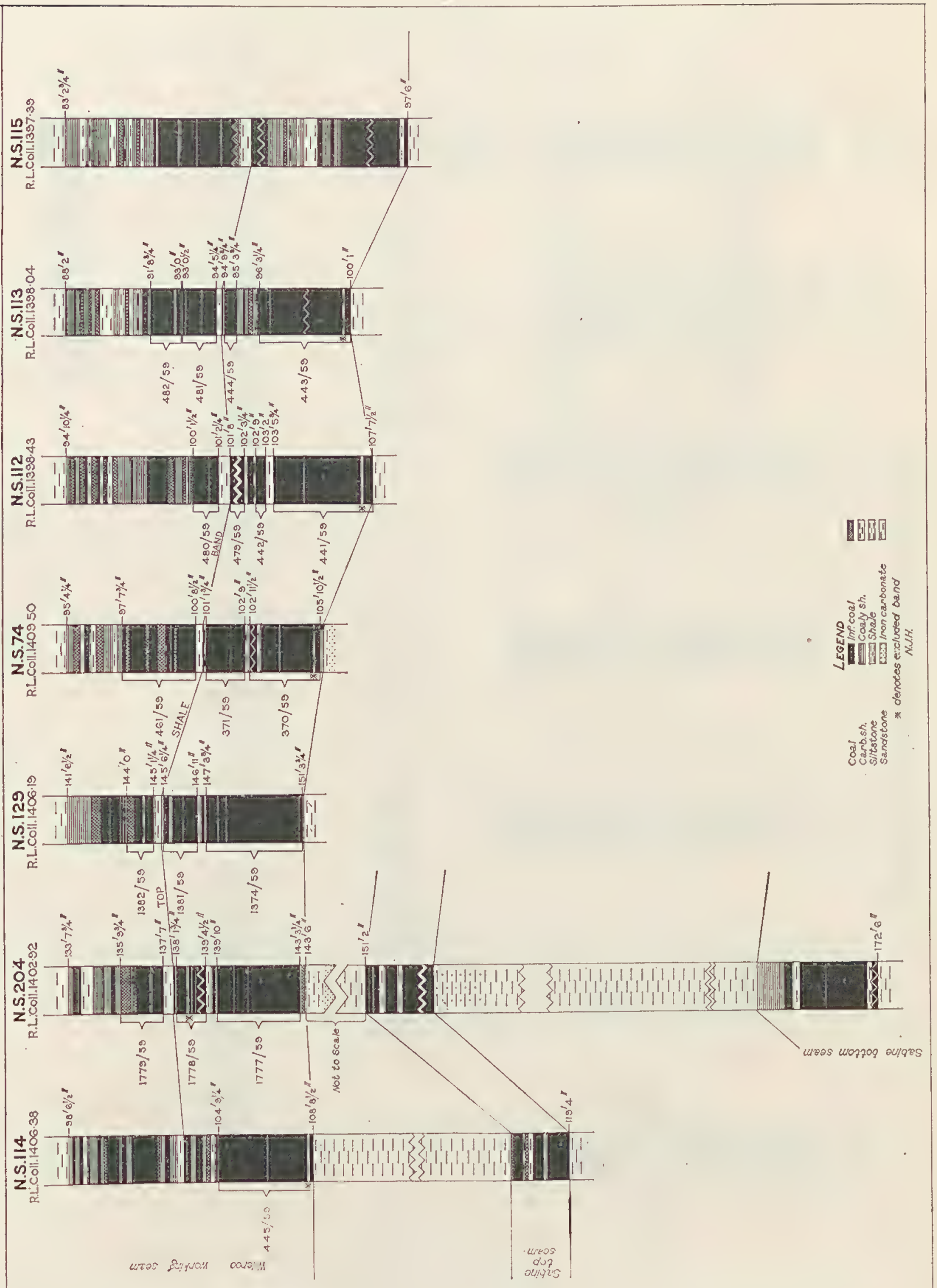


FIG. 8

WILLEROO MINE AREA— DETAILED SEAM SECTIONS

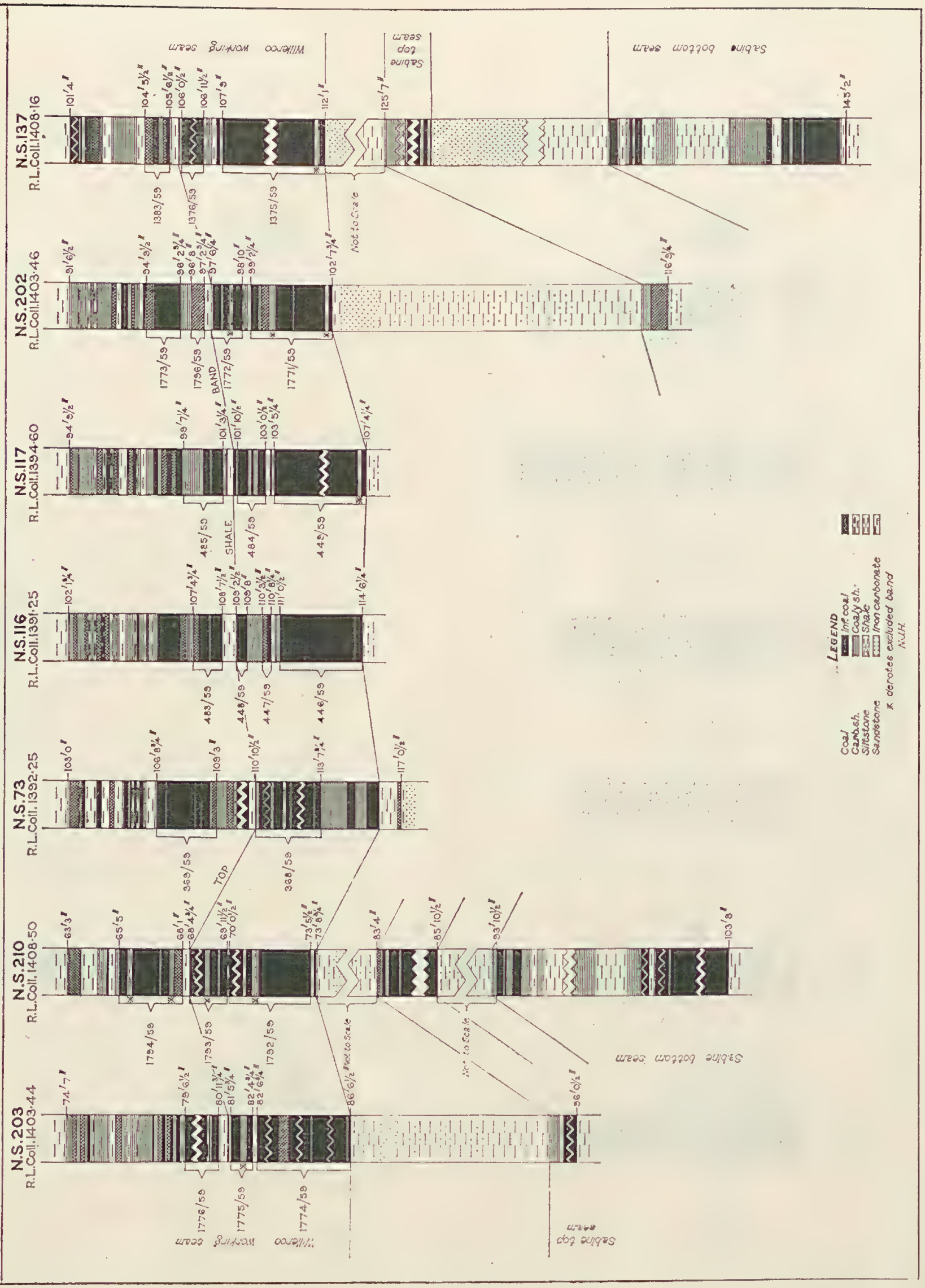


FIG. 9

WILLEROO MINE AREA — DETAILED SEAM SECTIONS

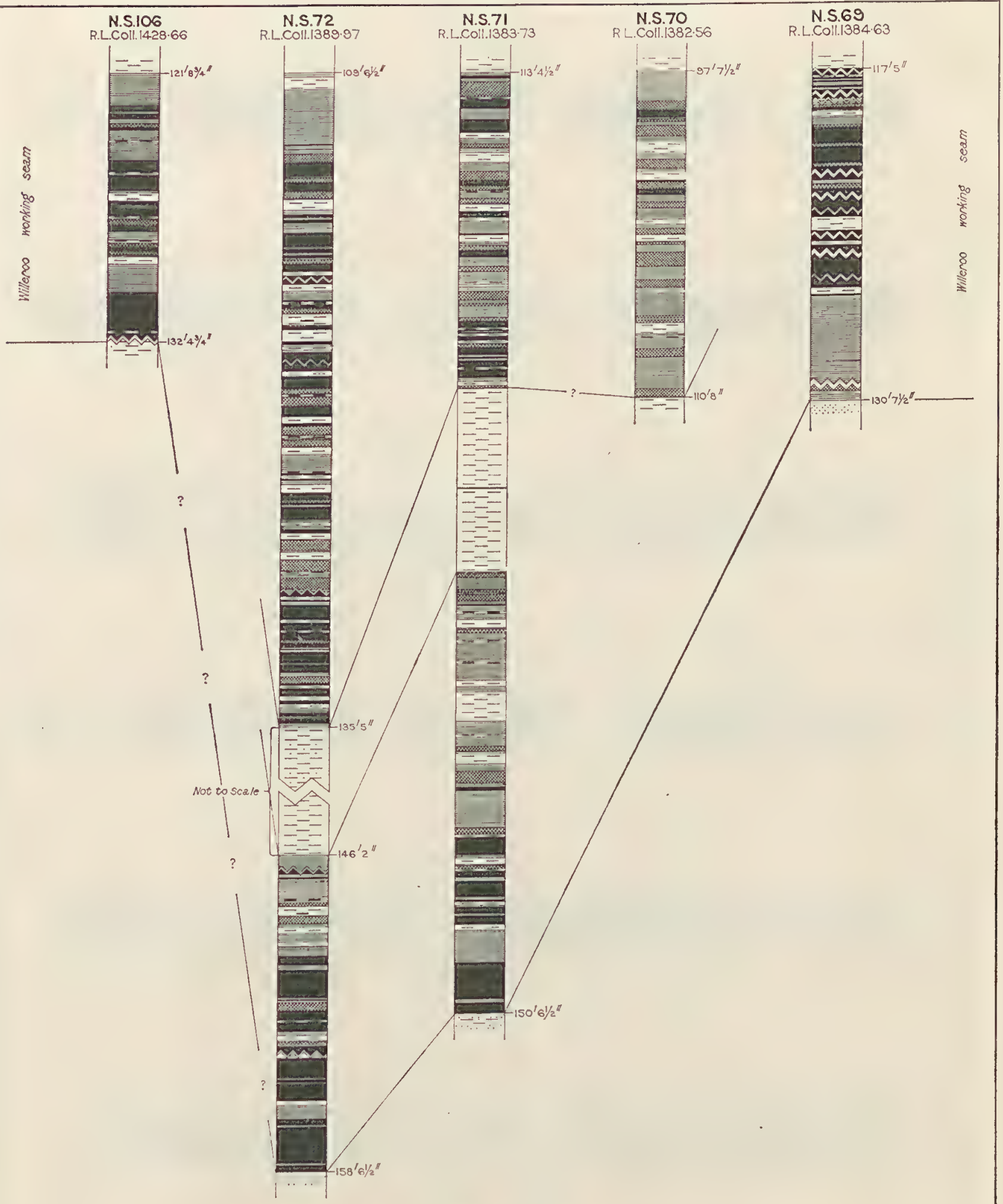


FIG.10

WILLEROO MINE AREA—DETAILED SEAM SECTIONS

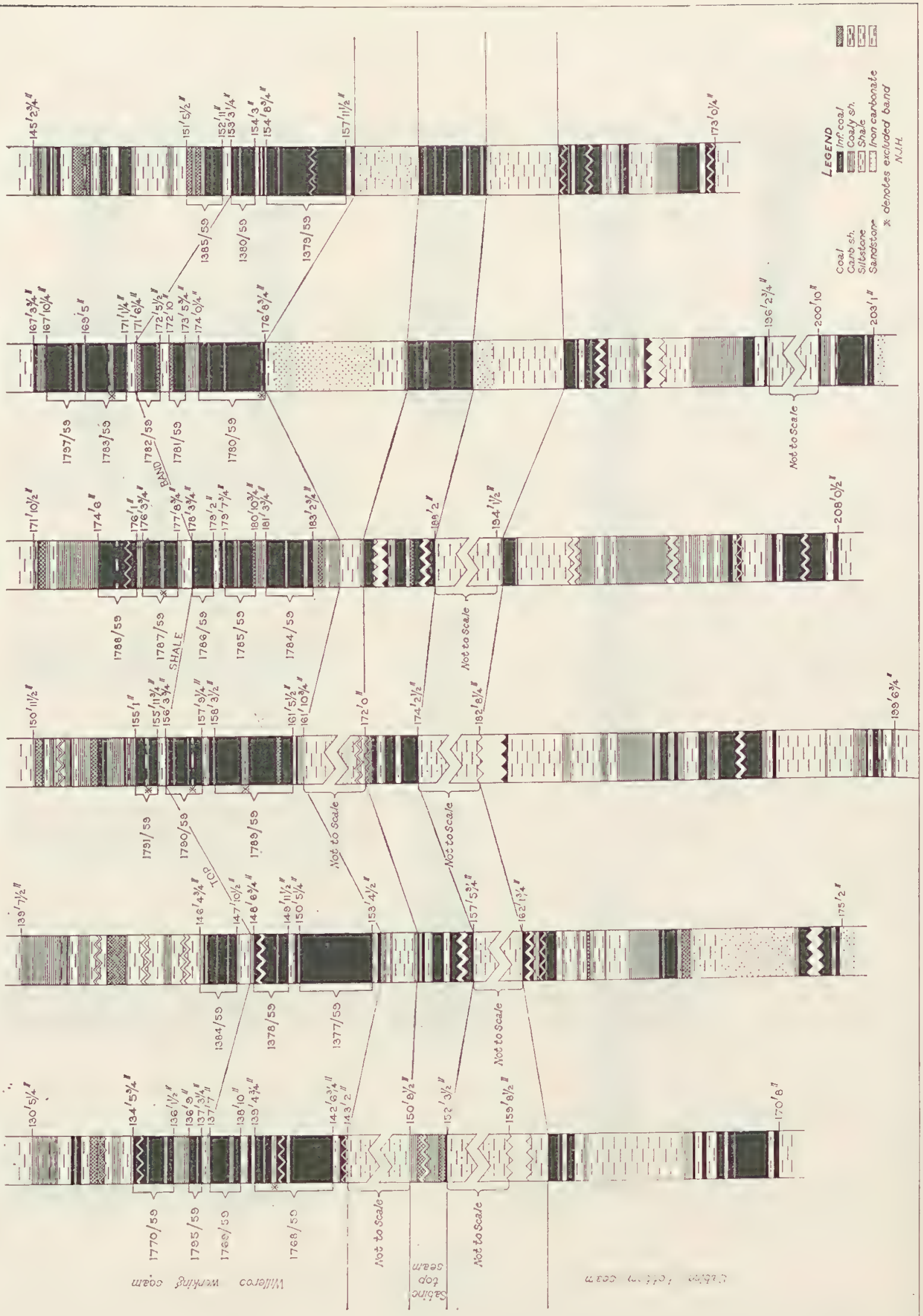


FIG. 11

WILLEROO MINE AREA—DETAILED SEAM SECTIONS

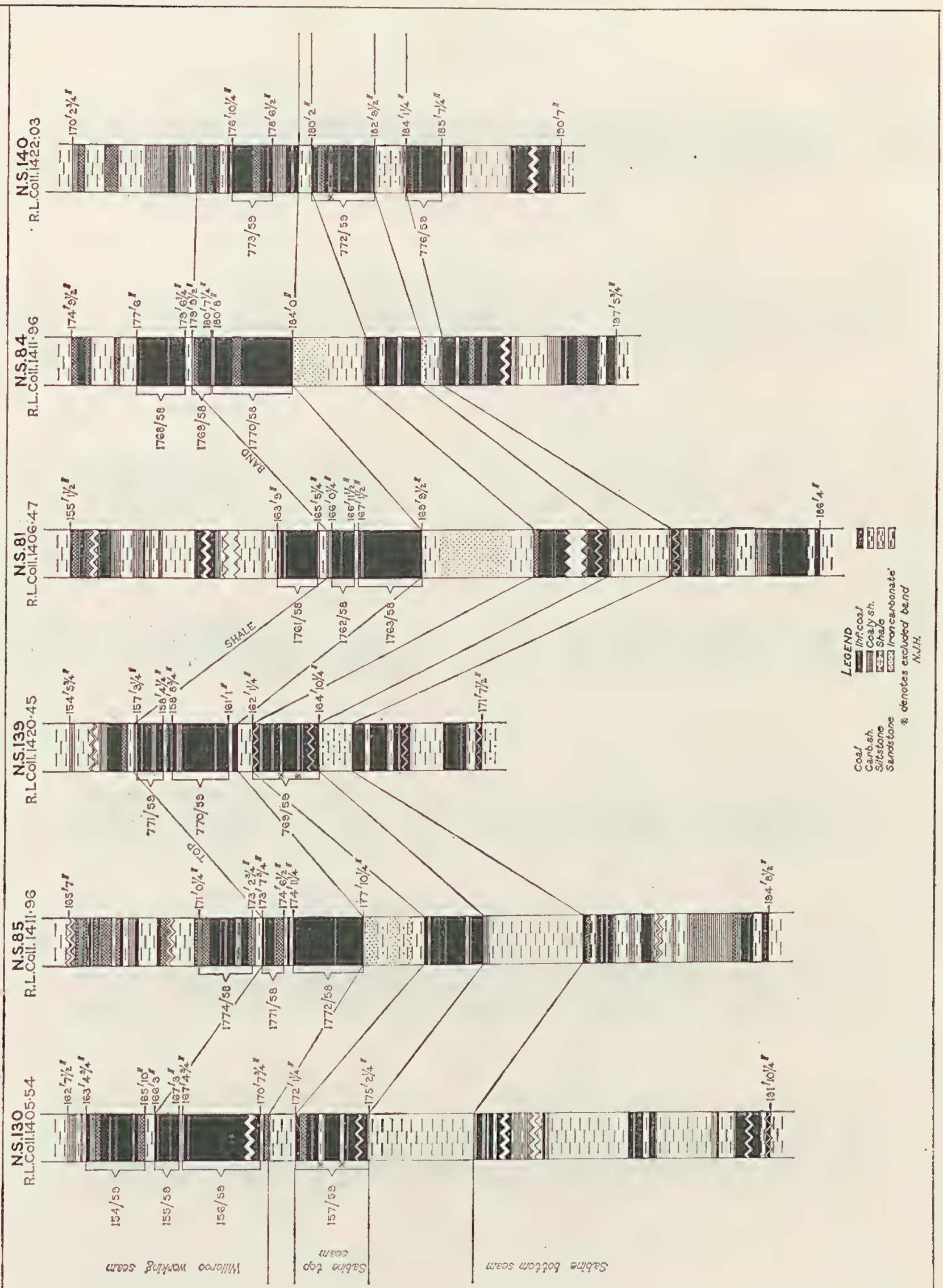


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FIG.12

WILLEROO MINE AREA— DETAILED SEAM SECTIONS

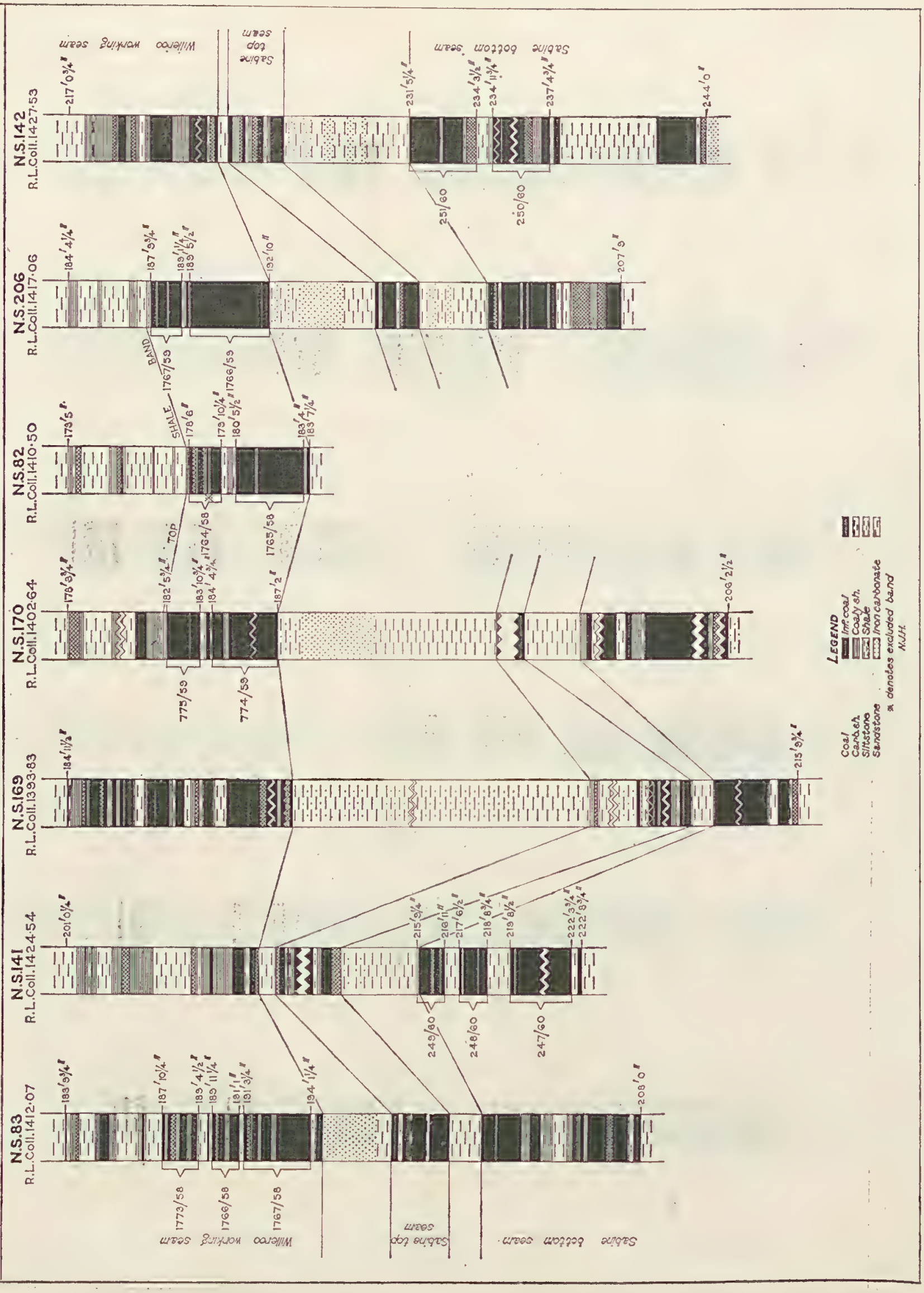


FIG.13

WILLEROO MINE AREA— DETAILED SEAM SECTIONS

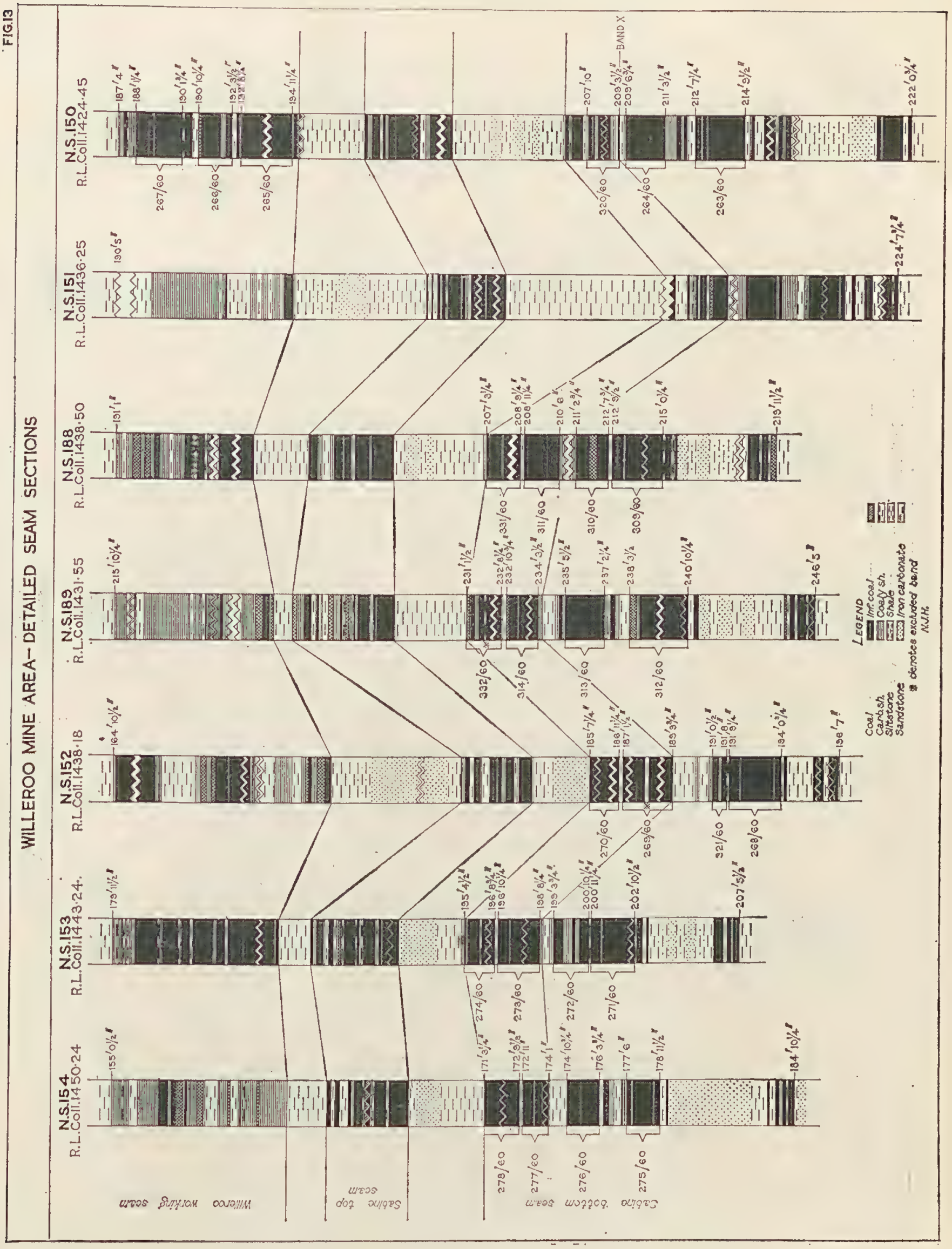


FIG. 14

WILLEROO MINE AREA – DETAILED SEAM SECTIONS

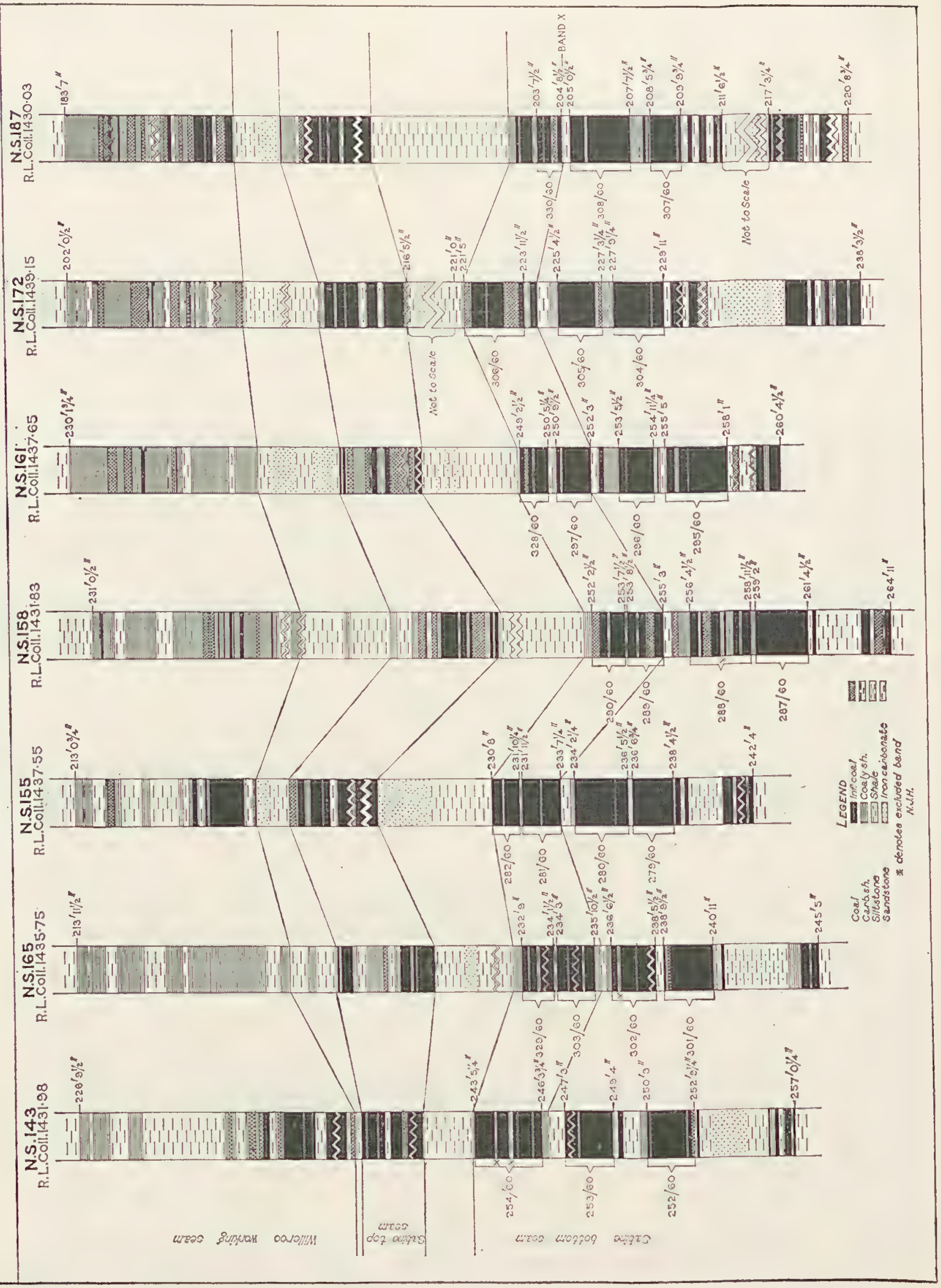


FIG.15

WILLEROO MINE AREA—DETAILED SEAM SECTIONS

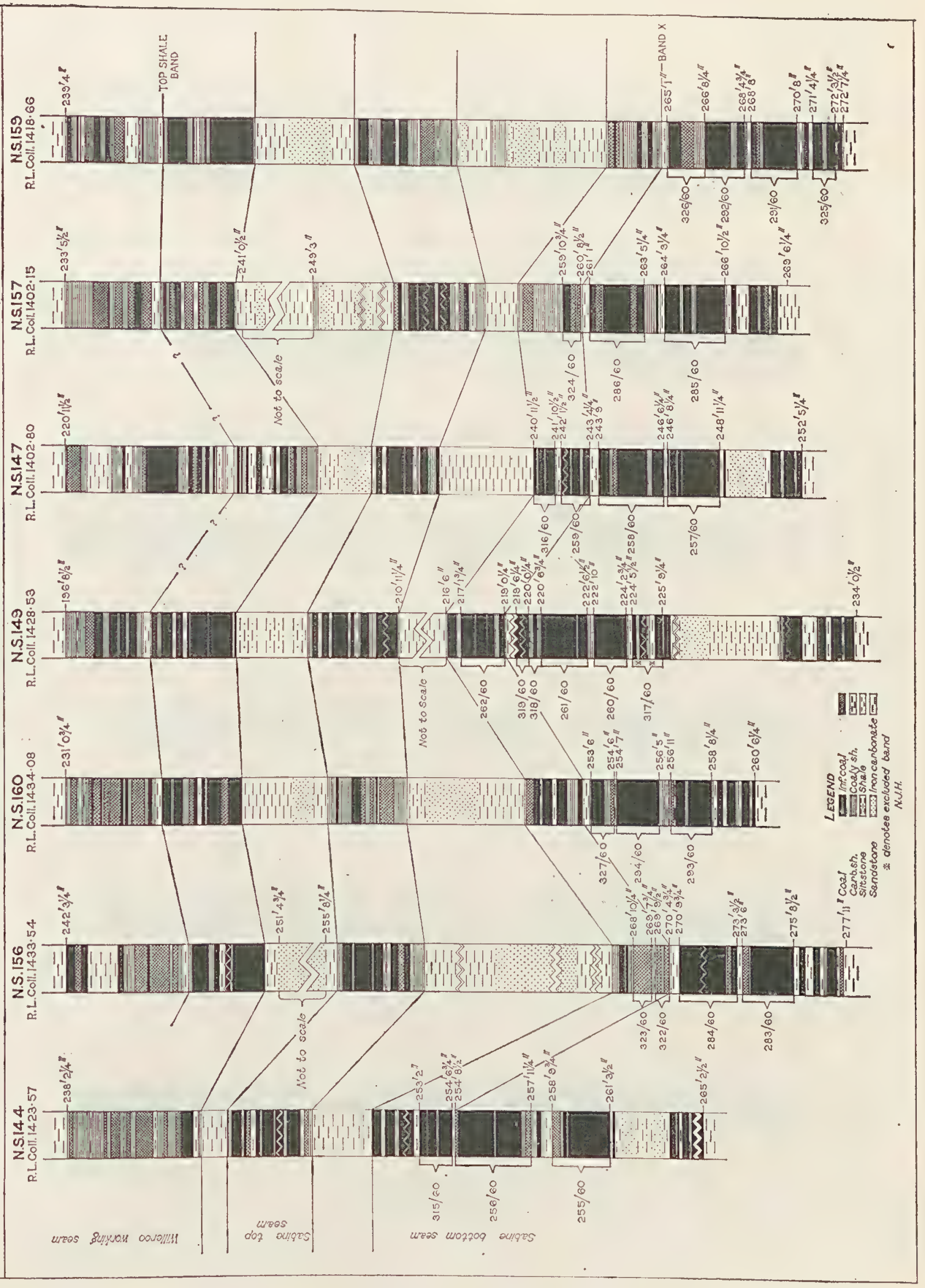


FIG.16

WILLEROO MINE AREA—DETAILED SEAM SECTIONS

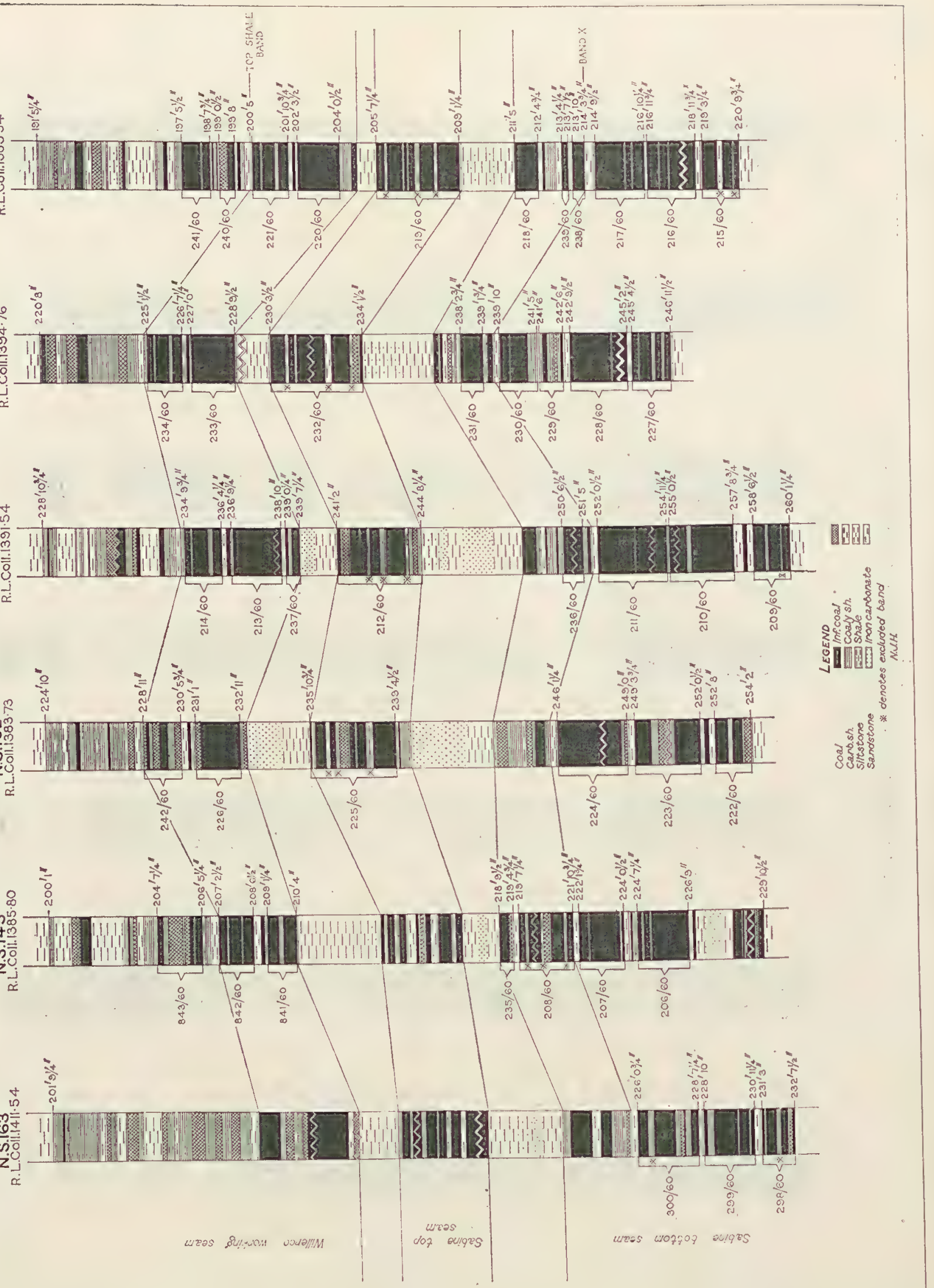


TABLE OF RECOVERIES AND ANALYSES

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis: Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
73	Willeroo working seam	106 8¾—109 3	2 6¼	100	369/59	4·0	35·7	30·4	29·9	..	0·47	9520	1·479	..
		110 10½—113 7¾	2 9¼	91	368/59	5·6	33·2	34·3	26·9	..	0·53	9640	1·464	..
74	Willeroo working seam	97 7¾—100 8½	3 0¾	100	461/59	..	..	..	28·8	..	..	..	..	..
		101 1¾—102 9	1 7¼	100	371/59	4·3	38·4	38·2	19·1	19·35	0·43	11200	1·380	..
		102 11½—105 10½	2 11	97·5	370/59	4·6	37·6	38·3	19·5		0·47	11450	1·391	..
75	Willeroo working seam	104 6 —107 4	2 10	97	374/59	2·8	37·7	32·8	26·7	..	0·44	10300	1·425	..
		108 0¼—110 1¼	2 1	74	373/59	4·0	35·0	32·0	29·0	25·35	0·66	10150	1·466	..
		110 4 —112 11	2 7	84	372/59	3·5	38·7	35·4	22·4		0·58	10860	1·401	..
81	Willeroo working seam	163 9 —165 5¼	1 8¼	100	1761/58	3·9	32·5	28·9	34·7	..	0·81	8830	1·514	..
		166 0¼—166 11½	0 11¼	100	1762/58	4·4	34·2	33·1	28·3	24·53	0·54	9690	1·461	..
		167 1½—169 9½	2 8	99·5	1763/58	3·9	37·7	35·2	23·2		0·48	10560	1·403	..
82	Willeroo working seam	178 6 —179 10¼	1 4¼	100	1764/58	4·3	35·9	32·8	27·0	20·60	0·42	9900	1·440	..
		180 5½—183 4	2 10½	99·5	1765/58	4·6	38·8	38·5	18·1		0·43	11310	1·362	..
83	Willeroo working seam	187 10¼—189 4½	1 5¼	100	1773/58	..	..	..	37·3	..	..	..	1·540	..
		189 11½—191 1	1 1¾	100	1766/58	4·1	35·8	32·4	27·7	23·99	0·33	11280	1·442	..
		191 3¼—194 1¼	2 10	100	1767/58	4·3	36·8	36·4	22·5		0·43	10500	1·403	..
84	Willeroo working seam	177 6 —179 6¼	2 0¼	100	1768/58	4·7	33·9	34·3	27·1	..	0·47	9800	1·447	..
		179 9½—180 7¼	0 9¾	100	1769/58	3·9	33·3	30·7	32·1	21·32	0·38	9210	1·482	..
		180 8 —184 0	3 4	100	1770/58	4·2	38·5	38·6	18·7		0·12	11220	1·366	..
85	Willeroo working seam	171 0¼—173 2¾	2 2½	100	1774/58	..	..	..	32·3	..	..	..	1·495	..
		173 7¾—174 6½	0 10¾	99·5	1771/58	3·6	32·0	28·2	36·2	22·67	0·36	8430	1·527	..
		174 11¼—177 10¼	2 11	100	1772/58	3·4	40·1	38·0	18·5		0·40	11480	1·369	..
97	Willeroo working seam	105 6¼—106 6¾	1 0½	100	471/59	..	..	..	29·6	..	..	..	..	..
		106 11¾—107 9¾	0 10	100	409/59	3·6	39·0	39·4	18·0	13·37	0·49	11550	1·355	..
		108 6½—113 1¾	4 7¼	98·5	408/59	3·5	43·1	41·3	12·1		0·48	12450	1·303	..
98	Willeroo working seam	109 4½—113 3	3 10½	100	410/59	3·5	41·3	40·3	14·9	14·9	0·47	12060	1·327	..
112	Willeroo working seam	100 1½—101 2¼	1 0¾	100	480/59	..	..	..	22·4	..	..	..	..	..
		101 8 —102 3¼	0 7¼	68·5	479/59	..	..	..	15·0	..	..	..	..	..
		102 9 —103 2	0 5	100	442/59	3·3	40·7	38·1	17·9	..	0·44	11690	1·343	..
		103 5¾—107 7½	4 1¾	100	441/59	3·6	42·6	39·2	14·6	14·6	0·44	12040	1·321	..
113	Willeroo working seam	91 8¾— 93 0	1 3¼	100	482/59	..	..	..	26·4	..	..	..	..	..
		93 0½— 94 5¼	1 4¾	100	481/59	..	..	..	23·9	..	..	..	..	..
		94 9¾— 95 3¾	0 6	92	444/59	4·4	41·5	47·2	6·9	15·01	0·55	13120	1·275	..
		96 3¼—100 1	3 9¾	97	443/59	3·9	42·0	38·0	16·1		0·47	11870	1·335	..
114	Willeroo working seam	104 9¼—108 8½	3 11¼	100	445/59	4·0	41·4	39·6	15·0	15·0	0·47	11810	1·331	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
116	Willeroo working seam	107 4¾—108 7½	1 2¾	100	483/59	..	..	..	27·6	..	..	..	..	..
		109 2½—109 8	0 5½	100	448/59	4·3	39·7	42·4	13·6	16·6	0·55	11990	1·323	..
		110 3½—110 8¼	0 4¾	100	447/59	4·1	39·2	36·0	20·7		0·49	10970	1·378	..
		111 0½—114 6¼	3 5¾	100	446/59	3·9	40·2	39·4	16·5		0·47	11750	1·343	..
117	Willeroo working seam	99 7¼—101 3¼	1 8	100	485/59	..	..	..	30·8	..	..	..	..	..
		101 10½—103 0½	1 2	100	484/59	..	..	..	27·9	17·99	..	..	..	..
		103 5¼—107 4¼	3 11	94	449/59	4·4	41·0	39·7	14·9		0·51	11970	1·329	..
129	Willeroo working seam	144 0 —145 1¼	1 1¼	100	1382/59	..	..	..	23·6	..	..	..	..	..
		145 6½—146 11	1 4¾	97	1381/59	..	..	..	25·0	18·77	..	..	..	..
		147 3¾—151 3¾	4 0	98·5	1374/59	4·0	39·9	39·5	16·6		0·52	11380	1·372	..
130	Willeroo working seam	163 4¾—165 10	2 5¼	100	154/59	4·5	33·0	30·0	32·5	..	0·37	8940	1·493	..
		166 3 —167 3	1 0	100	155/59	4·6	33·2	31·0	31·2	24·47	0·34	9090	1·486	..
		167 4¾—170 7¾	3 3	91·5	156/59	4·2	38·5	34·9	22·4		0·39	10500	1·398	..
	Sabine top seam ..	172 1¼—175 2¼	3 1	95	157/59	5·4	36·4	36·1	22·1	..	0·47	10340	1·406	..
137	Willeroo working seam	104 5½—105 6½	1 1	100	1383/59	..	..	..	29·6	..	..	..	..	..
		106 0½—106 11½	0 11	87	1376/59	4·5	37·9	36·7	20·9	16·49	0·48	10820	1·401	..
		107 9 —112 1	4 4	88·5	1375/59	4·6	40·7	39·2	15·5		0·48	11540	1·351	..
138	Willeroo working seam	151 5½—152 11	1 5½	100	1385/59	..	..	..	35·7	..	..	..	..	..
		153 3¼—154 3	0 11¾	96	1380/59	5·1	33·5	34·0	27·4	18·50	0·43	9500	1·455	..
		154 8¾—157 11½	3 2¾	97·5	1379/59	4·7	40·3	39·2	15·8		0·36	11500	1·350	..
139	Willeroo working seam	157 3½—158 4¼	1 1	100	771/59	4·3	33·4	29·7	32·6	..	0·39	8990	1·493	Cw
		158 8¾—161 1	2 4¼	98·5	770/59	4·6	38·6	32·7	24·1	..	0·43	10350	1·414	Af/Cw
	Sabine top seam ..	162 1¼—164 10¼	2 9	94	769/59	4·7	35·8	33·5	26·0	..	0·38	9850	1·443	Cw
140	Willeroo working	176 10¼—178 6½	1 8¼	100	773/59	4·1	38·0	35·2	22·7	..	0·51	10690	1·397	Cw
	Sabine top seam ..	180 2—182 9½	2 7½	100	772/59	4·9	33·8	30·8	30·5	..	0·41	9040	1·486	Cw
	Sabine bottom seam	184 1¼—185 7¼	1 6	100	776/59	5·2	37·4	38·2	19·2	..	0·52	10960	1·377	Cw
141	Sabine bottom seam	215 9¼—216 11	1 1¾	100	249/60	4·8	36·7	33·8	24·7	..	0·50	10090	1·434	Af/Cw
		217 6½—218 8¾	1 2¼	100	248/60	5·8	35·6	35·5	23·1	..	0·54	10170	1·422	Af/Cw
		219 8½—222 3¾	2 7¼	91	247/60	5·0	37·4	38·2	19·4	..	0·51	10770	1·394	Af/Cw
142	Sabine bottom seam	231 5¼—234 3½	2 10¼	100	251/60	5·3	35·1	33·6	26·0	..	0·45	9620	1·466	Af/Cw
		234 11¾—237 4¾	2 5	89·5	250/60	5·0	38·9	35·3	20·8	..	0·53	10670	1·395	Af/Cw
143	Sabine bottom seam	243 5¼—246 3¾	2 10½	100	254/60	5·1	36·8	34·2	23·9	..	0·47	10030	1·438	Af
		247 3 —249 4	2 1	71	253/60	4·4	39·7	36·4	19·5	20·09	0·54	11070	1·386	Cw
		250 9 —252 9¼	2 0¼	100	252/60	5·5	36·3	37·5	20·7		0·46	10430	1·414	Af

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
144	Sabine bottom seam	253 2 —254 6¾	1 4¾	100	315/60	..	..	..	32·7	..	..	..	..	..
		254 8½—257 11¼	3 2¾	99	256/60	5·6	38·7	37·2	18·5	18·72	0·47	11070	1·378	Cw
		258 9¾—261 3½	2 5¾	100	255/60	5·4	37·7	37·9	19·0		0·44	10870	1·393	Cw
145	Willeroo working seam	204 7¼—206 5¼	1 10	100	843/60	..	..	..	33·6	..	..	..	..	..
		207 2½—208 6½	1 4	100	842/60	..	..	..	24·1	..	..	..	..	..
		209 1¼—210 4	1 2¾	100	841/60	..	..	..	20·8	..	..	..	..	..
	Sabine bottom seam	218 9½—219 4¾	0 7¼	100	235/60	..	..	..	16·9	..	..	..	..	..
		219 7¼—221 10¾	2 3½	96·5	208/60	4·3	38·5	33·2	24·0	..	0·54	10260	1·420	Af/Cw
		222 1¾—224 0½	1 10¾	100	207/60	4·9	39·5	38·3	17·3	17·25	0·67	11130	1·372	Cw
		224 7¼—226 9	2 1¾	100	206/60	4·9	39·8	38·1	17·2		0·45	11340	1·366	Cw
146	Willeroo working seam	234 9¾—236 4¼	1 6½	100	214/60	4·5	35·8	32·1	27·6	21·87	0·42	9660	1·456	Af
		236 9¼—238 10	2 0¾	96	213/60	4·5	41·3	36·6	17·6		0·41	11250	1·367	Af/Cw
		239 0¼—239 7¼	0 7	100	237/60	..	..	..	26·3	..	..	..	..	..
	Sabine top seam ..	241 2 —244 8¼	3 6¼	98	212/60	5·0	37·6	33·9	23·5	23·5	0·55	10140	1·418	Af
	Sabine bottom seam	250 6½—251 5	0 11½	90·5	236/60	..	..	..	18·9	..	..	..	..	..
		252 0½—254 11¼	2 10¾	98	211/60	3·7	40·1	34·0	22·2	21·19	0·44	10400	1·416	Cw
		255 0½—257 8¾	2 8¼	94	210/60	5·1	37·4	37·4	20·1		0·43	10730	1·399	Af/Cw
		258 6½—260 1¼	1 6¾	94·5	209/60	5·8	38·4	41·5	14·3	..	0·57	11580	1·350	Af/Cw
147	Sabine bottom seam	240 11½—241 10½	0 11	100	316/60	..	..	..	28·5	..	..	..	..	..
		242 1½—243 4¼	1 2¾	88	259/60	4·5	37·6	32·7	25·2	..	1·08	10130	1·429	Af
		243 9 —246 6¼	2 9¼	100	258/60	4·6	37·3	35·2	22·8	21·14	0·54	10480	1·416	Af
		246 8¼—248 11¼	2 3	96·5	257/60	4·7	38·8	37·4	19·1		0·46	10940	1·389	Af
148	Willeroo working seam	197 5½—198 7¾	1 2¼	94·5	241/60	..	..	..	27·0	..	..	..	..	..
		199 0½—199 8	0 7½	100	240/60	..	..	..	29·5	..	..	..	..	..
		200 5 —201 10¾	1 5¾	100	221/60	4·4	36·5	34·2	24·9	18·56	0·39	10130	1·430	Af
		202 3½—204 0½	1 9	100	220/60	4·3	41·6	40·9	13·2		0·38	12010	1·337	Cw
	Sabine top seam ..	205 7¼—209 1¼	3 6	99	219/60	4·6	37·8	36·3	21·3	21·3	0·38	10580	1·407	Af
	Sabine bottom seam	211 5 —212 4¾	0 11¾	100	218/60	3·0	41·4	37·7	17·9	..	0·54	11260	1·372	Af
		213 4¼—213 7½	0 3¼	100	239/60	..	..	..	10·7	..	..	..	..	..
		213 10 —214 3¾	0 5¾	87	238/60	..	..	..	12·4	..	..	..	..	..
		214 9½—216 10¼	2 0¾	100	217/60	3·6	39·2	34·4	22·8	22·19	0·44	10690	1·400	Af/Cw
		216 11¾—218 11¾	2 0	91·5	216/60	4·6	35·5	35·4	24·5		0·39	10070	1·438	Af/Cw
		219 3¼—220 9¾	1 6½	100	215/60	5·1	38·1	39·3	17·5		0·50	11120	1·374	Af/Cw
149	Sabine bottom seam	217 1¾—219 0¼	1 10½	100	262/60	5·6	44·9	20·7	28·8	..	0·41	9300	1·467	Af
		219 6¼—220 0¼	0 6	83·5	319/60	..	..	..	16·4	*exclu-	..	..	..	..
		220 0¼—220 6¾	0 6	100	318/60	..	..	..	46·4*	ded	..	..	..	..
		220 6¾—222 6½	1 11¾	100	261/60	3·4	38·3	33·1	25·2	21·46	0·51	10140	1·435	Af
		220 10 —224 2¾	1 4¾	100	260/60	4·9	38·3	35·7	21·1		0·50	10510	1·405	Af
		224 5½—225 9¼	1 3¾	94	317/60	..	..	...	17·0		..	..	..	..

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
150	Willeroo working seam	188 1¼—190 1¾	2 0½	100	267/60	3·7	34·8	27·3	34·2	..	0·40	9050	1·506	Af
		190 10¼—192 3½	1 5¼	100	266/60	3·7	38·0	30·8	27·5	..	0·42	9900	1·458	Af
		192 8¼—194 11¼	2 3	90	265/60	4·8	41·4	41·6	12·2	..	0·46	12210	1·333	Af/Cw
	Sabine bottom seam	207 10 —209 3½	1 5½	92	320/60	..	..	..	33·6	..	..	..	..	..
		209 6¾—211 3½	1 8¾	96·5	264/60	3·9	42·6	39·5	14·0	..	0·50	11800	1·339	Af/Cw
		212 7¼—214 9½	2 2¼	98	263/60	4·3	38·9	38·7	18·1	..	0·48	11190	1·382	Af
152	Sabine bottom seam	185 7¼—186 11¼	1 4	81	270/60	3·6	39·5	35·7	21·2	..	0·43	10700	1·401	Af
		187 1½—189 3¾	2 2¼	86	269/60	4·4	36·8	33·8	25·0	..	0·48	10090	1·431	Af/Cw
		191 0½—191 8	0 7½	100	321/60	..	..	..	32·0	..	..	..	..	..
		191 9¼—194 0¾	2 3½	100	268/60	4·4	38·4	36·8	20·4	..	0·46	10900	1·388	Af/Cw
153	Sabine bottom seam	195 4½—196 8¾	1 4¼	91	274/60	4·7	43·4	28·6	23·3	..	0·47	10380	1·423	Af
		196 10¼—198 8¼	1 10	95·5	273/60	6·0	36·3	37·3	20·4	..	0·48	10490	1·403	Af
		199 3¾—200 10¼	1 6½	100	272/60	3·9	37·3	32·4	26·4	..	0·53	10200	1·432	Cw
		200 11¼—202 10½	1 11¼	96	271/60	4·8	39·1	36·1	20·0	..	0·43	10610	1·390	Af
154	Sabine bottom seam	171 3¼—172 9½	1 6¼	94·5	278/60	4·6	38·0	36·7	20·7	..	0·43	10540	1·395	Af
		172 11 —174 1	1 2	93	277/60	5·9	34·1	33·1	26·9	..	0·55	9430	1·469	Af
		174 10¾—176 3¾	1 5	100	276/60	4·6	37·7	35·5	22·2	..	0·46	10460	1·418	Cw
		177 6 —178 11½	1 5½	100	275/60	5·4	33·8	34·3	26·5	..	0·42	9640	1·468	Af/Cw
155	Sabine bottom seam	230 8 —231 10¼	1 2½	100	282/60	5·2	36·5	34·1	24·2	..	0·46	10020	1·443	Af
		231 11½—233 7¼	1 7¾	100	281/60	6·2	34·1	32·8	26·9	..	0·36	9380	1·461	Af
		234 2¼—236 5½	2 3¼	100	280/60	4·9	37·4	34·6	23·1	18·71	0·45	10520	1·417	Af
		236 6¾—238 4½	1 9¾	100	279/60	5·3	39·9	41·5	13·3		0·44	11690	1·345	Af
156	Sabine bottom seam	268 10¼—269 7¾	0 9½	95	323/60	..	..	..	29·2	..	..	..	..	..
		269 9½—270 4¾	0 7¼	100	322/60	..	..	..	25·2	..	..	..	..	..
		270 9¾—273 3½	2 5¾	95	284/60	4·6	39·4	38·6	17·4	18·29	0·53	11290	1·366	Af/Cw
		273 6 —275 8½	2 2½	95·5	283/60	4·9	38·5	37·3	19·3		0·45	10830	1·392	Af/Cw
157	Sabine bottom seam	259 10¾—260 8½	0 9¾	95	324/60	..	..	..	25·2	..	..	..	..	..
		261 1 —263 5¼	2 4¼	98·5	286/60	4·6	41·9	37·5	16·0	18·05	0·51	11710	1·356	Cw
		264 3¼—266 10½	2 7¼	93·5	285/60	5·2	37·9	37·0	19·9		0·52	10790	1·392	Af/Cw
158	Sabine bottom seam	252 2½—253 7½	1 5	100	290/60	4·8	37·3	33·6	24·3	..	0·46	10030	1·429	Af
		253 8½—255 3	1 6½	100	289/60	5·1	34·7	32·1	28·1	..	0·52	9500	1·473	Af
		256 4½—258 11½	2 7	100	288/60	4·7	36·6	34·6	24·1	19·18	0·50	10330	1·431	Af
		259 2 —261 4½	2 2½	100	287/60	5·7	38·8	41·7	13·8		0·57	11670	1·352	Cw
159	Sabine bottom seam	265 1 —266 8¼	1 7¼	100	326/60	..	..	..	37·2	..	..	..	..	..
		266 8¼—268 4¾	1 8½	100	292/60	3·9	39·7	36·8	19·6	17·31	0·67	11170	1·376	Af
		268 8 —270 8	2 0	100	291/60	5·1	38·4	39·3	17·2		0·59	11270	1·369	Af/Cw
		271 4¼—272 3½	0 11¼	100	325/60	..	..	..	13·4		..	..	..	..
160	Sabine bottom seam	253 6 —254 6	1 0	100	327/60	..	..	..	24·6	..	..	..	..	..
		254 7 —256 5	1 10	100	294/60	4·1	40·5	39·7	15·7	20·12	0·48	11550	1·357	Cw
		256 11 —258 8¼	1 9¼	100	293/60	4·7	36·4	35·6	23·3		0·46	10230	1·423	Cw

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
161	Sabine bottom seam	249 2½—250 5¼	1 2¾	96·5	328/60	..	..	..	29·3	..	..	..	..	..
		250 9½—252 3	1 5½	96	297/60	5·0	36·9	34·3	23·8	..	0·42	10240	1·420	Af/Cw
		253 5½—254 11¼	1 5¾	100	296/60	4·7	37·5	35·8	22·0	20·39	0·43	10570	1·410	Af/Cw
		255 5 —258 1	2 8	98·5	295/60	4·6	38·0	37·9	19·5		0·44	10890	1·389	Af/Cw
162	Willeroo working seam	228 11 —230 5¾	1 6¾	100	242/60	..	..	..	28·4	23·37	..	..	..	..
		231 1 —232 11	1 10	100	226/60	4·3	40·4	36·2	19·1		0·33	11180	1·378	Cw
	Sabine top seam ..	235 10¾—239 4½	3 5¾	100	225/60	4·7	37·6	33·1	24·6	24·6	0·60	10080	1·428	Af
	Sabine bottom seam	246 1¼—249 0	2 10¾	95·5	224/60	4·5	40·0	37·1	18·4	19·66	0·40	11240	1·375	Cw
		249 3¾—252 0½	2 8¾	95·5	223/60	4·4	38·7	35·9	21·0		0·50	10760	1·393	Af/Cw
		252 8 —254 2	1 6	100	222/60	4·7	34·7	32·5	28·1	..	0·42	9970	1·479	Af
163	Sabine bottom seam	226 0¾—228 7¼	2 6½	100	300/60	3·6	34·5	36·5	25·4	24·35	0·48	10200	1·435	Af/Cw
		228 10 —230 11¼	2 1¼	100	299/60	4·2	37·7	34·9	23·2		0·43	10420	1·421	Af/Cw
		231 3 —232 7½	1 4½	100	298/60	5·2	37·1	38·4	19·3	..	0·49	10880	1·396	Af/Cw
164	Willeroo working seam	225 1½—226 7¼	1 5¾	100	234/60	4·5	36·9	33·6	25·0	18·92	0·39	10050	1·423	Af/Cw
		227 0 —228 9½	1 9½	97·5	233/60	4·3	41·7	40·1	13·9		0·36	11840	1·329	Cw
	Sabine top seam ..	230 3½—234 1½	3 10	98	232/60	5·0	39·0	37·5	18·5	18·5	0·45	10860	1·377	Af/Cw
	Sabine bottom seam	238 2¾—239 1¾	0 11	100	231/60	4·8	38·3	38·7	18·2	..	0·51	10930	1·378	Af/Cw
		239 10 —241 5	1 7	100	230/60	3·1	40·8	32·3	23·8	24·98	0·51	10600	1·404	Af/Cw
		241 6 —242 6	1 0	100	229/60	3·9	33·8	24·1	38·2		0·43	8080	1·550	Af
		242 9½—245 2	2 4½	91	228/60	4·2	39·4	36·1	20·3		0·49	10890	1·391	Af/Cw
		245 4½—246 11½	1 7	92	227/60	5·2	35·6	36·4	22·8	..	0·46	10270	1·424	Af/Cw
165	Sabine bottom seam	232 9 —234 1½	1 4½	94	329/60	..	..	..	25·8	..	..	..	..	..
		234 3 —235 10½	1 7½	95	303/60	6·0	35·0	36·4	22·6	..	0·53	10110	1·424	Af/Cw
		236 6½—238 5½	1 11	91	302/60	4·5	39·1	36·0	20·4	19·64	0·50	10850	1·392	Cw
		238 9½—240 11	2 1½	100	301/60	5·2	36·8	39·0	19·0		0·44	10870	1·397	Af/Cw
170	Willeroo working seam	182 5¾—183 10¾	1 5	100	775/59	5·9	34·7	33·2	26·2	19·45	0·32	9610	1·442	Af
		184 4¾—187 2	2 9¼	97	774/59	5·7	39·1	39·2	16·0		0·37	11470	1·347	Cw
172	Sabine bottom seam	221 5 —223 11½	2 6½	97·5	306/60	3·7	36·8	33·6	25·9	..	0·48	9820	1·449	Af/Cw
		225 4½—227 3¼	1 10¾	100	305/60	6·1	36·7	36·6	20·6	19·80	0·47	10970	1·385	Cw
		227 9¼—229 11	2 1¾	100	304/60	5·0	37·4	38·5	19·1		0·52	10090	1·390	Af/Cw
180	Willeroo working seam	146 4¾—147 10½	1 5¾	100	1384/59	..	..	..	34·4	..	..	..	..	..
		148 6¾—149 11½	1 4¾	88	1378/59	4·5	36·8	34·7	24·0	17·77	0·45	10180	1·419	..
		150 5¼—153 4½	2 11¼	100	1377/59	4·8	39·1	41·3	14·8		0·53	11630	1·349	..
187	Sabine bottom seam	203 7½—204 8½	1 1	100	330/60	..	..	..	31·4	..	..	..	..	..
		205 0½—207 7½	2 7	100	308/60	4·1	39·9	34·9	21·1	19·57	0·48	10580	1·409	Af
		208 5¾—209 9¾	1 4	100	307/60	5·3	38·3	39·8	16·6		0·48	11320	1·359	Af/Cw

TABLE OF RECOVERIES AND ANALYSES—*continued*

N.S. Bore No.	Seam	Coal Section Depth Ft. in. — Ft. in.	Sample Thickness Ft. in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity	Coking Classification
188	Sabine bottom seam	207 3¼—208 9¼	1 6	80·5	331/60	..	..	..	25·9	..	..	..	..	..
		208 11¼—210 6	1 6¾	100	311/60	6·1	33·4	34·2	26·3	..	0·45	9560	1·459	Af
		211 2¾—212 7¾	1 5	100	310/60	4·8	39·3	39·4	16·5	19·13	0·53	11480	1·367	Af/Cw
		212 9½—215 0¼	2 2¾	96·5	309/60	4·9	37·2	37·1	20·8		0·51	10610	1·404	Af
189	Sabine bottom seam	231 1½—232 8¼	1 6¾	84	332/60	..	..	..	23·8	..	..	..	..	..
		232 10¾—234 3½	1 4¾	93	314/60	5·8	35·8	38·1	20·3	..	0·63	10570	1·402	Af
		235 5½—237 2¼	1 8¾	100	313/60	4·5	39·7	38·8	17·0	18·01	0·44	11360	1·376	Cw
		238 3½—240 10¼	2 6¾	90	312/60	5·3	36·8	39·2	18·7		0·60	10980	1·388	Cw
201	Willeroo working seam	134 5¾—136 1½	1 7¾	94	1770/59	4·5	35·4	32·6	27·5	..	0·42	9700	1·448	..
		136 9 —137 3¼	0 6¼	100	1795/59	..	..	..	21·0	..	..	..	..	..
		137 7 —138 10	1 3	100	1769/59	4·0	37·9	31·9	26·2	19·92	0·34	10240	1·422	..
		139 4¾—142 6¾	3 2	91·5	1768/60	5·0	39·6	38·3	17·1		0·43	11370	1·361	..
202	Willeroo working seam	94 9½— 96 2¾	1 5¼	100	1773/59	5·3	36·2	35·2	23·3	..	0·46	10290	1·426	..
		96 8 — 97 2¾	0 6¾	100	1796/59	..	..	..	28·5	..	..	..	..	..
		97 6¼— 98 10	1 3¾	100	1772/59	4·5	37·3	35·4	22·8	16·71	0·44	10590	1·419	..
		99 2¼—102 7¾	3 5½	100	1771/59	4·6	40·5	40·4	14·5		0·45	11850	1·347	..
203	Willeroo working seam	79 6½— 80 11¾	1 5¼	82·5	1776/59	4·0	37·4	32·6	26·0	..	0·39	10040	1·447	..
		81 5¾— 82 4¾	0 11	100	1775/59	4·4	40·8	40·8	14·0	15·99	0·44	12020	1·340	..
		82 6¾— 86 6½	3 11¾	92	1774/59	4·6	39·8	39·3	16·3		0·59	11510	1·362	..
204	Willeroo working seam	135 9¾—137 7	1 9¼	100	1779/59	3·9	34·7	29·9	31·5	..	0·50	9370	1·487	..
		138 1¾—139 4½	1 2¾	90	1778/59	3·8	34·8	31·8	29·6	18·69	0·39	9600	1·479	..
		139 10 —143 3¼	3 5¼	100	1777/59	4·0	40·1	40·4	15·5		0·36	11720	1·376	..
206	Willeroo working seam	187 9¾—189 1¼	2 3½	100	1767/59	5·3	35·2	33·6	25·9	20·78	0·44	9630	1·460	..
		189 5½—192 10	3 4½	100	1766/59	5·0	41·3	36·4	17·3		0·45	11170	1·375	..
207	Willeroo working seam	167 10¼—169 5	1 6¾	100	1797/59	..	..	..	32·3	..	..	..	..	..
		169 5 —171 1¼	1 8¼	100	1783/59	4·2	35·9	32·1	27·8	..	0·49	9690	1·452	..
		171 6¼—172 5½	0 11¼	96	1782/59	4·6	36·6	34·5	24·3	19·69	0·55	10340	1·421	..
		172 10 —173 5¾	0 7¾	100	1781/59	4·5	40·1	44·0	11·4		0·68	12400	1·319	..
		174 0¼—176 8¾	2 8½	100	1780/59	4·5	39·1	36·3	20·1		0·63	11050	1·387	..
208	Willeroo working seam	174 6 —176 1	1 7	95	1788/59	4·0	36·1	31·9	28·0	..	0·42	9830	1·468	..
		176 3¾—177 8¾	1 5	97	1787/59	4·6	39·0	37·4	19·0	..	0·47	11100	1·388	..
		178 3¾—179 2	0 10¼	100	1786/59	5·0	35·6	34·6	24·8	21·24	0·31	10000	1·440	..
		179 7¾—180 10¾	1 3	100	1785/59	5·1	38·5	30·6	25·8		0·29	9890	1·444	..
		181 3¾—183 2¾	1 11	96	1784/59	3·9	42·3	37·1	16·7		0·60	11690	1·342	..
209	Willeroo working seam	155 1 —155 11¾	0 10¾	100	1791/59	4·4	36·7	33·7	25·2	..	0·48	10290	1·426	..
		156 3¾—157 9¼	1 5½	100	1790/59	4·6	33·6	31·4	30·4	19·51	0·43	9120	1·505	..
		158 3½—161 5½	3 2	100	1789/59	4·1	41·8	39·6	14·5		0·49	11910	1·348	..
210	Willeroo working seam	65 5 — 68 1	2 8	100	1794/59	4·5	34·5	29·2	31·8	..	0·48	9560	1·492	..
		68 4¾— 69 11½	1 6¾	90·5	1793/59	6·3	33·8	36·4	23·5	14·69	0·44	10140	1·442	..
		70 0½— 73 5½	3 5	90·5	1792/59	4·8	41·6	42·4	11·2		0·53	12240	1·311	..

APPENDIX 1

EXPLORATORY DRILLING TO EAST OF WILLEROO MINE AREA

Three prospecting boreholes (N.S. 177-179) were drilled at 20 chain intervals along the roadway to Greenwood School as an easterly extension of drilling in subdivision 33, portion 1038, parish Watts (C.P.A. 27–Willeroo). Aggregate footage was 557 ft. 1 in. (206 ft. 3 in. non-coring).

This report is accompanied by—

(1) A plan showing the location of the prospecting boreholes—figure A.

(2) Diagrams of detailed seam sections in boreholes—figure B.

The Coal Seams (see detailed seam sections)

The Willeroo working seam is workable in all boreholes. A section of approximately 3 ft. 6 in. of coal exists in this seam.

The Sabine top seam is separated from the above seam by only a few inches of shale. In N.S. 178 and 179 the full seam section (approximately 3 ft. 10 in.) is workable. The quality of the bottom part of the seam deteriorates to the west and, in N.S. 177, only the upper 2 ft. 0 in. is of good quality.

The interval between the Sabine top and bottom seams decreases to the east from 9 ft. 5 in. of siltstone, shale and fine sandstone (N.S. 177) to 5 ft. 0 in. of siltstone and shale (N.S. 179).

The Sabine bottom seam in this area is divided into two sections by a double shale band (two shale bands separated by a few inches of coal). This double band increases in thickness from 1 ft. 3 in. (N.S. 177) to 3 ft. 4 in. (N.S. 179). The upper coal section of this seam may prove to be workable in all three boreholes even though, to the west, carbonaceous shale bands are present in the section which is approximately 5 ft. thick. The lower coal section is strongly banded and unworkable.

CONCLUSION

These prospecting boreholes have proved that the three seams encountered in drilling in the Willeroo Mine Area are of probable economic interest to the east of the mine area.

If the shale band between the Willeroo working seam and Sabine top seam does not thicken greatly then the target for future exploratory work should be these two seams which could be worked as one.

The Sabine bottom seam also offers some inducements for further prospecting.

TABLE OF RECOVERIES AND ANALYSES

N.S. Bore No.	Seam	Coal Section Ft.	Coal Section in.	Sample Thickness Ft.	Sample Thickness in.	Recovery Percentage	G.S. Sample No.	Proximate Analysis Moist. %	Vol. Mat. %	F.C. %	Ash %	Weighted Av. Ash % Workable Section	Sulphur %	Calorific Value B.T.U.s/lb.	Specific Gravity
177	Willeroo working seam	147	5½—148 9	1	3½	100	1408/59	..	..	..	26·1	17·96	..	..	..
		149	1¼—151 7	2	5¾	96·5	1398/59	4·7	40·0	41·5	13·8		0·37	11840	1·342
	Sabine top seam ..	152	4¾—154 10½	2	5¾	96·5	1397/59	4·7	39·2	38·6	17·6		0·52	11220	1·367
178	Willeroo working seam	138	4 —139 10¼	1	6¼	100	1402/59	4·5	38·0	35·4	22·1	17·55	0·39	10410	1·416
		140	3 —142 2¾	1	11¼	100	1401/59	5·0	39·9	41·5	13·6		0·40	11710	1·356
	Sabine top seam ..	143	3 —145 9	2	6	91	1400/59	4·8	37·5	36·1	21·6		0·42	10500	1·410
		146	0¼—147 5	1	4¾	83·5	1399/59	5·7	39·7	42·7	11·9		0·48	11910	1·333
179	Willeroo working seam	135	7½—137 3	1	7½	100	1407/59	5·1	38·5	36·9	19·5	17·8	0·47	10910	1·395
		137	7¼—140 1	2	5¾	82·5	1406/59	4·4	40·2	40·7	14·7		0·38	11540	1·359
	Sabine top seam ..	140	11¼—142 8¾	1	9½	100	1405/59	4·3	37·5	34·9	23·3		0·31	10200	1·431
		142	11 —145 0½	2	1½	92·5	1404/59	5·6	38·4	40·5	15·5		0·41	11380	1·373
	Sabine bottom seam	150	1½—155 0	4	10½	88·5	1403/59	3·2	42·1	39·2	15·5	15·5	0·51	11850	1·358

FIG. A

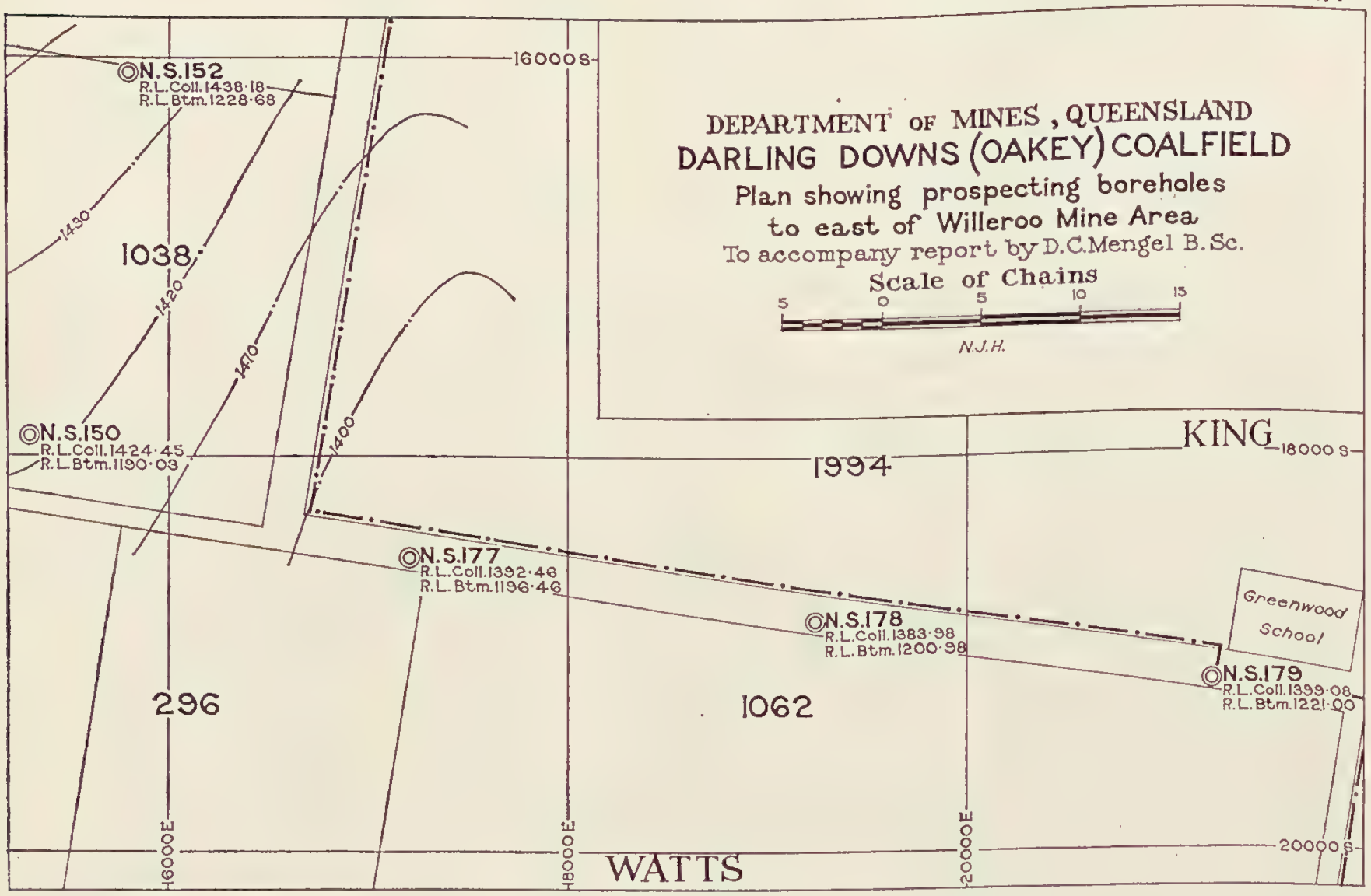
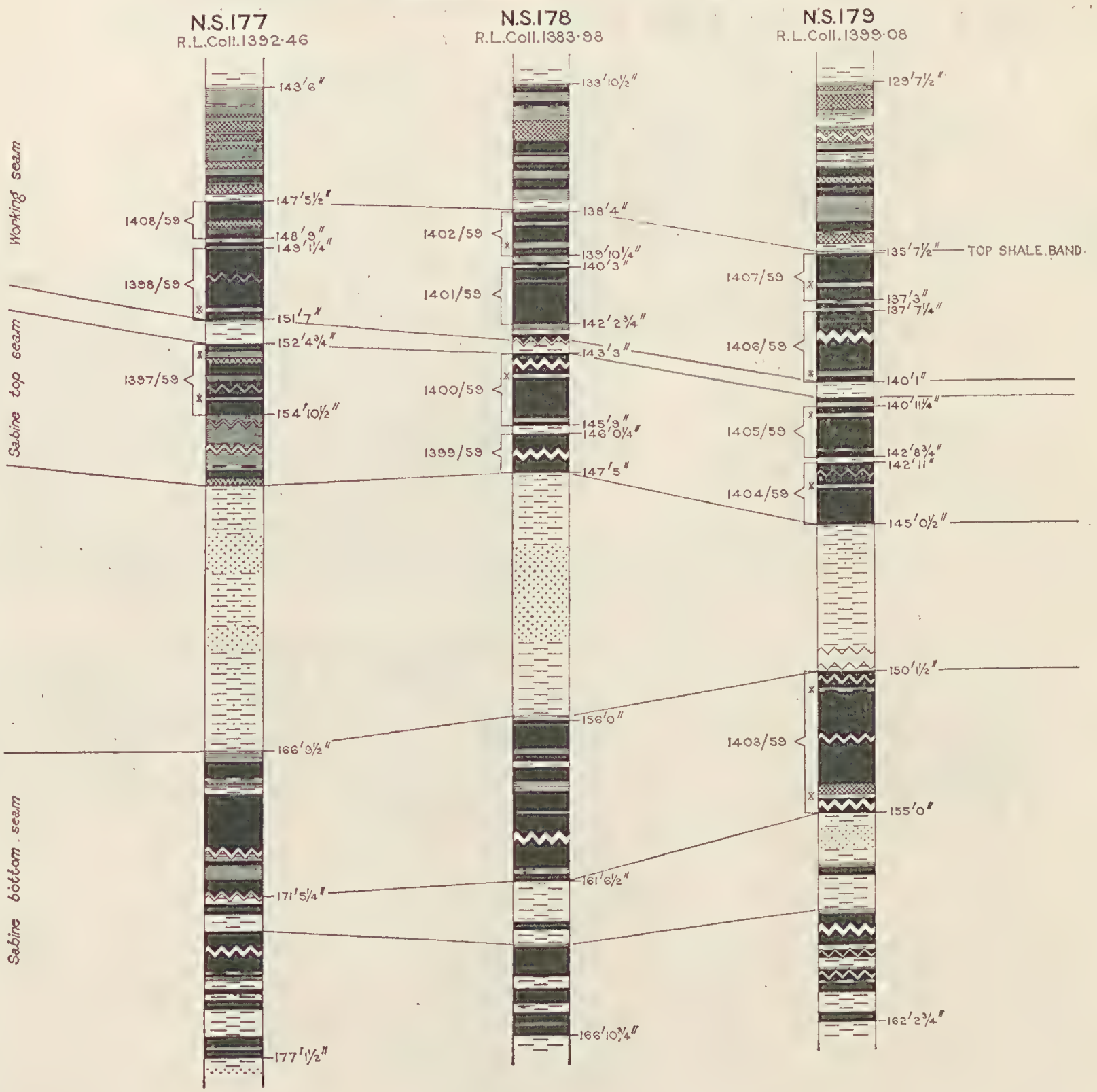

DEPARTMENT OF MINES, QUEENSLAND
DARLING DOWNS (OAKEY) COALFIELD
Plan showing prospecting boreholes
to east of Willeroo Mine Area
To accompany report by D.C.Mengel B.Sc.
Scale of Chains
5 0 5 10 15
N.J.H.
16000S
18000S
20000S
KING
WATTS
N.S.152
R.L.Coll.1438·18
R.L.Btm.1228·68
N.S.150
R.L.Coll.1424·45
R.L.Btm.1190·03
N.S.177
R.L.Coll.1392·46
R.L.Btm.1196·46
N.S.178
R.L.Coll.1383·98
R.L.Btm.1200·98
N.S.179
R.L.Coll.1399·08
R.L.Btm.1221·00
1430
1420
1410
1400
1038
1994
296
1062
Greenwood School
16000E
18000E
20000E

FIG 8

DETAILED SEAM SECTIONS—PROSPECTING BOREHOLES



LEGEND

- Shale
- Siltstone
- Sandstone
- Carb. shale
- Inferior coal
- Coal
- ※ denotes excluded band

N.J.H.

APPENDIX II

PALYNOLOGY OF A SAMPLE FROM BORE N.S. 209 (OAKEY COALFIELD)

By N. J. DE JERSEY, Ph.D., M.Sc.

The sample examined consisted of a coal core ¾ in. in thickness, from a depth of 617 ft. 4 in. in this bore (in the Willeroo Mine Area). This thin seam is approximately 130 ft. below the productive coal measures in this area. Palynological examination was requested to provide evidence on the age of the sediments underlying the coal measures.

On maceration the sample yielded abundant spores and pollens, the following being identified:—

Leptolepidites verrucatus (40%)
L. sp.
Osmundacidites sp. (23%)
Tsugaepollenites segmentatus (3%)
T. dampieri (3%)
Araucariacites cf. australis
Inaperturopollenites cf. turbatus
I. sp.
Leiotriletes directus
L. cf. crassus
L. sp.
Sphagnumsporites tenuis
S. adnatus
Cingulatisporites saevus
Entylissa nitidus
Annulispora folliculosa
Acanthotriletes pallidus
Lycopodiumsporites rosewoodensis
L. sp.
Verrucosisporites sp.
Granulatisporites minor
Pityosporites cf. parvisaccatus
P. sp.
Rugulatisporites ramosus
Gleicheniidites cf. circinidites

This assemblage has been compared with the microfloras of the Bundamba Group, Marburg Sandstone and Walloon Coal Measures. In the microfloras from the type areas of these formations, there are marked differences between the assemblages of the Bundamba and Marburg, while the microfloras of the Marburg and Walloon are so similar that they cannot be distinguished on present knowledge. The assemblage in this Willeroo sample is of the same general character as the Marburg–Walloon microflora; it thus indicates that the adjacent sediments below the coal measures in the Oakey district should be correlated with the Marburg Sandstone rather than with the Bundamba Group.

Features of interest in the present assemblage are the abundance of *Leptolepidites verrucatus* and *Osmundacidites sp.* These forms, though present, are much less abundant in the Walloon–Marburg microflora. Their abundance in this sample may be due either to local environmental conditions or to the horizon studied being slightly different from any previously examined.

S. G. REID, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

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(312) Coal Resources, Rosewood–Walloon Coalfield. Rosewood No. 2 Mine Area New Malabar Mine Area. J. B. CAMERON, B.Sc. Caledonian No. 5 Mine Area. Neath Mine Area—Supplement. E. S. CHIU CHONG, B.Sc. (Demy Quarto). 1963.

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